The OIL AND GAS JOURNAL

MAY 19, 1958

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. . . and keeps its field engineers working full time on actual engineering work p. 106

How To Set a Drilling Record

p. 172

Five-Pay Wildcat Heralds New Province

p. 263

Midyear Refining Report

News account of the refining division meeting in Los Angeles, plus five of the most significant papers in full. Technical section starts on page 124.

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the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
May 19, 1958

TIPRO insiders are confident the Ikard bill will pass.

Texas independents and Ikard have agreed on several amendments. They will be presented in ways and means committee when the time comes.

First change: Eliminate Bureau of Mines forecasting and base quota on actual domestic production during the preceding quarter with provision for seasonal adjustments.

Second: Direct President to write regulations to protect small business and treat all interests equitably. This is attempt to mollify objections of small importers and Canadian-border refiners who fear big bidders for import licenses will freeze them out.

Strategy runs like this:

Producers of zinc, lead, copper and some other defense minerals will offer specific protection provisions. They and Ikard will work together to present such a strong front that administration will have to accept.

If committee doesn't approve, Ikard believes he can get a rule permitting his bill to be adopted on the floor. Or he expects sufficient strength to recommit to committee for inclusion of his bill.

In the Senate, the bill may be loaded with scores of protective tariffs and quotas on nondefense commodities. But these will be cut out in conference. Administration is expected to accept extension of trade act if the only specific restrictions are on oil and a few other defense minerals.

Intensive study of the oil industry is being made by economics staff of the Justice Department.

Aim is to make it easier for independents to compete with majors. Information developed won't necessarily be used for court cases but to guide state and federal legislative and administrative bodies.

Practices under study:

Interstate Oil Compact Commission, proration systems, crude price posting by purchasers, oil swap-out arrangements, growth of purchaser proration, control of pipelines by crude purchasers, domination of imports business by a few majors.

Phillips' strike in western Kansas may be the most impor-

tant in years for the Kansas-Colorado-Nebraska region. It may be the forerunner of a big drilling play for the Las Animas arch (p. 263).

The Phillips 1 Llanos found 114 ft. of possible Pennsylvanian pay in five separate zones down to 4,833 ft.

The well is in the center of a 22,380-acre block and part of a million-acre spread Phillips holds in western Kansas and eastern Colorado.

Swan Hills reservoir in Central Alberta has proven oil reserves of 80,000,000 bbl., probable reserves of 300,000,000, Home Oil consultants estimate.

Some of this acreage will revert to the Crown after the Home group finishes picking the tracts it wants to develop. The Home group, however, will still have more than 10,000 acres on which to concentrate development.

A mothball treatment has been developed to protect low-gravity, high water-cut wells shut in by California producers.

Highly refined aromatic product is added through the tubing after first unseating the pump. Enough is added to fill the liner.

The fluid plates the pipe while being injected and is effective under static conditions as a corrosion inhibitor. It also prevents build up of tension factors.

Proposed prairies-to-Montreal crude pipeline in Canada is getting very little support from larger producers. The testimony being given before current hearings of Borden Commission is preponderantly against the idea.

Prediction of McColl-Frontenac officials reflect feeling of most Canadian executives: U. S. will be forced to liberalize its oil imports policy by the early 1960's in order to conserve its remaining domestic oil resources.

Big argument against the line to Montreal: It is not economic and when current conditions change would be a big financial liability.

A monitoring system for spotting pipeline breaks has gone into operation on the 500-mile superinch line moving gas from Texas to the San Francisco Bay area (p. 104).

The automatic alarm system senses the break from abnormal flow conditions, closes valves to isolate the ruptured section, and reports location of trouble to nearest attended compressor station.

New technique of tremendous commercial value has been found to separate helium from natural gas (p. 107).

Process, developed in Bell Telephone Laboratories, works like this: Gaseous mixture is passed over the surface of a bundle of hair-like capillary glass tubes. The tubes have

high permeability to helium and low permeability to other gases.

Mixture flows around outside of tubes under high pressure. Helium is recovered from inside of capillaries.

More important: The diffusion cell may be placed directly in a gas pipeline to extract helium. This could step up immensely nation's ability to produce the gas.

Refiners can use presently known processes to turn out gasoline pool octanes of 100 to 102 and superpremium ratings up to 110 RON (p. 119).

How soon the industry will reach this quality level isn't known, researchers told API refining meet last week.

Same men say gasoline is becoming more and more a blend of tailor-made chemicals. The refiner in time will reach the point where he is producing chemical-grade components which can be sold either as petrochemicals or as motor fuel.

Other API notes: Conoco has a new corrosion inhibitor which promises to reduce acid-gas corrosion in plant units ...Key to halting middle-age spread on delayed-coking drums is a lower water-quenching rate...Fuel-research circles agree the industry needs a better yardstick for lab evaluation of high-octane gasoline in terms of performance on the road. Consensus is a strong research effort is needed immediately.

Contract for building Hess' new refinery at Port Reading, N.J., has been let to Lummus.

Site is a 100-acre, waterfront location on Arthur Kill where most of metropolitan New York's marine terminals are located.

Size of the plant still has not been revealed. Hess has been importing 11,400 bbl. daily under the voluntary program. The refinery will be large enough to handle that amount.

Plans for a 600-bbl. daily aromatic alkylation unit are still being kept alive by Eastern States Petroleum of Houston.

It will be completed by the end of this year and will be the first Alkar unit built under license from the developers, Universal Oil Products Co.

Vapor-recovery systems on crude-oil tanks can turn vapor losses into a profit.

Atlantic Refining is turning this trick in Block 31 field, Crane County, Texas, where it is the unit operator.

Here's what Atlantic does: Sweeps central storage-tank battery with simple gas blanket. This picks up vapors which are recovered in a nearby gasoline plant.

The system promises to yield an additional 10,000 gal. daily of light hydrocarbons from a field production of about 15,000 bbl. daily of crude.

Payout of the recovery equipment is expected to take less than 5 months.

A hard-selling advertising and sales-promotion program is getting the credit from Sunray Mid-Continent officials for spectacular sales of the company's gasoline.

D-X gasoline sales are up 10.2% for first quarter with sales of premium D-X Boron up 17.8%. Both are contrary to downward industry trends.

The hard-sell drive extends from executives right down to the station attendant.

Oil's heyday in guided missiles and rockets is dwindling.

Hydrocarbon fuels used in all air breather and liquid rockets eventually will be replaced with solid and storable liquid propulsion systems.

William M. Holaday, guided missiles chief, also says day of short-range manned interceptor is numbered. But manned jet bombers will be around for many years.

In the crystal ball: Daniel P. Barnard, Indiana Standard coordinator for research, says 100 million economy-size cars powered with gas-turbine engines may be crowding U.S. highways by 2,000 A.D. He adds the gas turbine isn't likely to become too influential within next 10 years.

A system to keep engineers busy on engineering work has been inaugurated by Atlantic Refining in its production department (p. 106).

Atlantic has trained and put to work a group of production engineering aides. They are former roustabouts, pumpers, accounting clerks who now make special tests, collect various data, and run routine calculations.

The payoff will come in better use of engineers.

More quarterly profits reports: Ashland, down to $2.4 million from $4.9 million for same quarter last year; Getty, down to $7 from $9.3 million; Hancock, down to $1.7 from $1.9 million; Richfield, down to $5.6 from $7 million, Sinclair, down to $16.4 from $26.3 million; Indiana Standard, down to $31.9 from $45.8 million; Tidewater, down to $803,000 from $11.4 million; Plymouth, down to $870,252 from $2.5 million; Cities Service Co., down to $13.5 from $23.4 million. Amerada, down from $8.7 to $5.5 million; Midwest Oil, down from $2.1 to $1.8 million; Anderson-Prichard, down from $1.4 million to $658,633; Pure, down from $10.1 to $4.7 million.

Industry notes: John B. Hussey, Louisiana conservation director, has been named to succeed retiring Seaborn Digby on the Federal Power Commission...Tennessee Gas Transmission is acquiring Middle States Petroleum Corp...General American Oil has bought holdings of Wrather group in East Texas field ...Angelus Oil Co. of California is merging into Texam Oil Corp. of San Antonio...

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Good Wells Make Good News

A Special Report on Successful Remedial Cementing Jobs

May 19, 1958

The success ratio of remedial cementing jobs has been materially improved since the introduction of Cealment®. Cealment is the exclusive Dowell cementing service, using a latex-cement. It is especially suited to remedial work. Here are four examples of successful application.

- **Stonewall County, North Texas.** (New Oil Well) This well was completed in the Strawn sand through perforations from 5110 to 5130 feet. Initial production was only 10 bopd with 70 bwpd. A 500-gallon squeeze was performed with Cealment, and the well was reperforated. *After fracturing, well tested 106 bopd with no water.*

- **Carbon County, Wyoming.** (Old Oil Well) This well, producing from 5852 to 6251 feet, was completed open hole in 1948. Recent attempts to stimulate production from selected intervals of the pay, with the aid of packers set in the open hole, had failed. The operators decided to set a 5" O.D. liner in the 400 feet of 6⅛" open hole. The liner was run, cemented with Cealment and perforated. Following a stimulation treatment, *production rose from 136 to 357 bopd while water production dropped from 209 to 27 bwpd.*

- **Cowley County, Eastern Kansas.** (New Oil Well) This Layton sand well was in an area noted for water problems due to cement channeling. For example, most wells in the pool produce three to five barrels of water to each barrel of oil. One offset well had been "squeezed" twice with regular portland cement, fractured three times without success, squeezed a third time, and then finally abandoned. The operators decided to try Cealment on this new well. A squeeze was performed at 2022 feet with 400 gallons Dowell latex-cement preceded by 200 gallons Mud Acid. Then a retainer was set at 1998 feet; and the well was squeezed at 2003 feet using 400 gallons of latex-cement with a spearhead of 50 gallons Mud Acid. Cement and retainer were drilled out, and the well was perforated from 2010 to 2014 feet and fractured. *After treatment, the well swabbed three boph with only two bwph.*

- **St. Landry Parish, South Louisiana.** (Old Oil Well) This well was completed through perforations from 8715 to 8722 feet. A channel in the primary cement job resulted in high salt water production. This posed a water disposal problem and prevented maximum allowable oil production. A squeeze of 900 gallons latex-cement, preceded by 200 gallons Mud Acid, was performed to cement off the channel. The job was completely successful. *The channel was repaired and water-free production was possible at top allowable.*

A recent survey of 866 cementing jobs using Cealment disclosed Dowell's latex-cement has proved exceptionally successful in all kinds of cementing work — primary cementing, tailing-in, setting liners, squeeze, plug backs and lost circulation. Ask for a free copy of this survey. For service or full information, contact your nearest Dowell service point. There are 165 in the United States and Canada. In Venezuela, contact United Oilwell Service. Dowell Incorporated, Tulsa, Oklahoma.

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the OIL AND GAS JOURNAL

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API REFINING REPORT

Shell's Waste Disposal at Anacortes . . . 124
By E. D. Neumann, C. J. Reno, and L. C. Burroughs

In planning for a refinery in the Puget Sound area, which has long been a sports and commercial fishing paradise, Shell Oil Co. made maximum efforts to insure that no harmful effects to wildlife resources and adjoining property would result from operation of the refinery.

Corrosion in Cat Reformers with Naphtha Pretreaters . . . 131
By E. B. Backensto and R. W. Manuel

Experience with catalytic reformers having naphtha pretreaters has borne out predictions that desulfurization of the charge to below 0.002% by weight of sulfur would reduce high-temperature hydrogen-hydrogen sulfide corrosion of carbon and low-chromium steels in the reforming section to a negligible level.

New Flare Is Smokeless and Nonluminous . . . 136
By P. D. Miller, Jr., H. J. Hibshman, and J. R. Connell

A new flare, called the multijet, provides completely smokeless and noiseless burning and promises to be an economical solution to most flaring problems. One installation has been in service for more than a year with good results.

How Hydrogenation Improves Cat Cracker Feed 144
By M. D. Abbott, R. C. Archibald, and R. W. Dorn

Hydrotreating of catalytic cracking feed stocks not only reduces the sulfur and nitrogen contents of the oil, but, under suitable conditions, converts a large proportion of the condensed polyaromatic compounds to monoaromatics.

New Light on Cat Cracker Feed Preparation . . 153
By M. V. Medlin, J. C. Ornea, and A. J. Johnson

Best pattern for future refinery construction is to reduce gradually production of No. 6 fuel oil and to maintain high gasoline yield by combining deep feed preparation with two-stage cat cracking.

TECHNOLOGY—OPERATION

San Juan Basin Gas Production Is Tough . . . 163
By A. J. Dudenhoeffer

Gas-well production within the San Juan basin can be maintained through the use of intermitters and plunger-lift equipment; these must, however, be used in various ways to fit individual well requirements. Liquid accumulation in the well bore and paraffin deposit within the production tubing can be eliminated. Increases in production range from 3.9% to as high as 212.5% in extreme cases.

How to Set a Gas-Drilling Record . . . 172
By Ed McGhee

The Magnolia Petroleum and Western Natural Gas 1 Brown-Bassett in Terrell County, Texas, has set the pattern for good drilling practices to guide other wells to be drilled in the area. It also set a depth record for gas drilling.

Three-Stage Separators Handle Two-Phase Flow . . . 176
By Larry Resen

Four separators, connected in parallel, are used to recover condensate from 135 M.M.c.f. of gas daily at Marine Gathering Co.'s separation station south of Lake Arthur, La. Condensate content of the two-phase stream reaching plant averages 6-7 bbl. per M.M.c.f. of gas, with about 875 bbl. of liquids being recovered by the separators.

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Pipeline Patrol: Who Picks Up the Tab for LACT? . . . 192
By Gene Kinney

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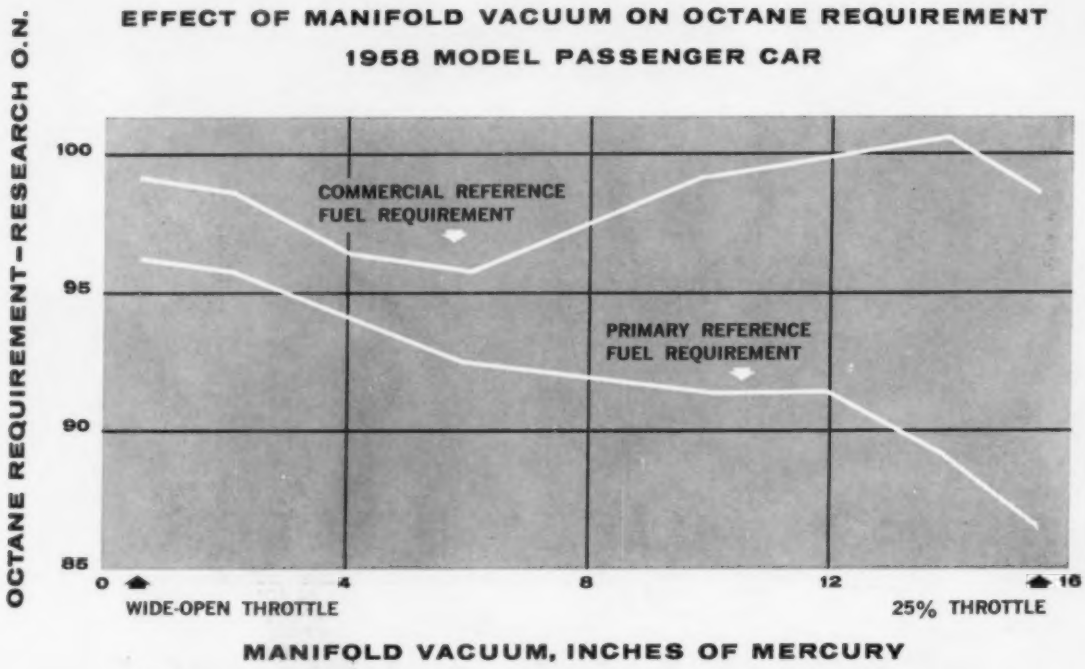

This chart illustrates the importance of part-throttle octane requirements and the difference in the performance of primary and commercial-type reference fuels.

Part-throttle octane requirements are critical in today's cars

BY W. E. MORRIS

Due to today's traffic conditions, very little passenger car driving is done at wide-open throttle. Therefore, the part-throttle antiknock efficiency of gasoline is of greater importance to refiners than ever before, especially as it applies to cars of higher horsepower.

This point, combined with the fact that fuels do not rate the same and are not always ranked in the same relative order at wide-open throttle as under part-throttle operating conditions, indicates that part-throttle road octane ratings may well be an even more important factor in blending the high octane fuels of tomorrow.

To prevent knock

The above chart shows the change in octane requirements with manifold vacuum for a 1958 model car. The Research octane number required to prevent knock with a typical commercial reference fuel exceeds the primary reference fuel requirement by three octane numbers at wide-open throttle and by 12 octane numbers at a part-throttle setting of 14 inches of mercury, manifold vacuum. In this car a typical 100 Research octane number commercial fuel would operate knock-free at wide-open throttle but would knock at 14 inches of mercury manifold vacuum.

For superior performance

Another finding of interest is that two gasolines with equal *wide-open throttle* road ratings can differ considerably in the performance at part-throttle. And studies at the Du Pont Petroleum Laboratory indicate that gasolines having *low sensitivities* give superior part-throttle performance.

Part-throttle knocking problems can best be avoided by planning future blends and by setting present specifications so as to give gasolines with good part-throttle knock resistance.

The Du Pont Petroleum Laboratory today offers refiners its data on part-throttle octane requirements and road ratings and, in the future, will release the additional information developed by its continuing research.

WILLIAM E. MORRIS, a specialist in antiknock research, is supervisor of the antiknock test group at the Du Pont Petroleum Laboratory. Before joining Du Pont, Mr. Morris did product development work for a major oil company.

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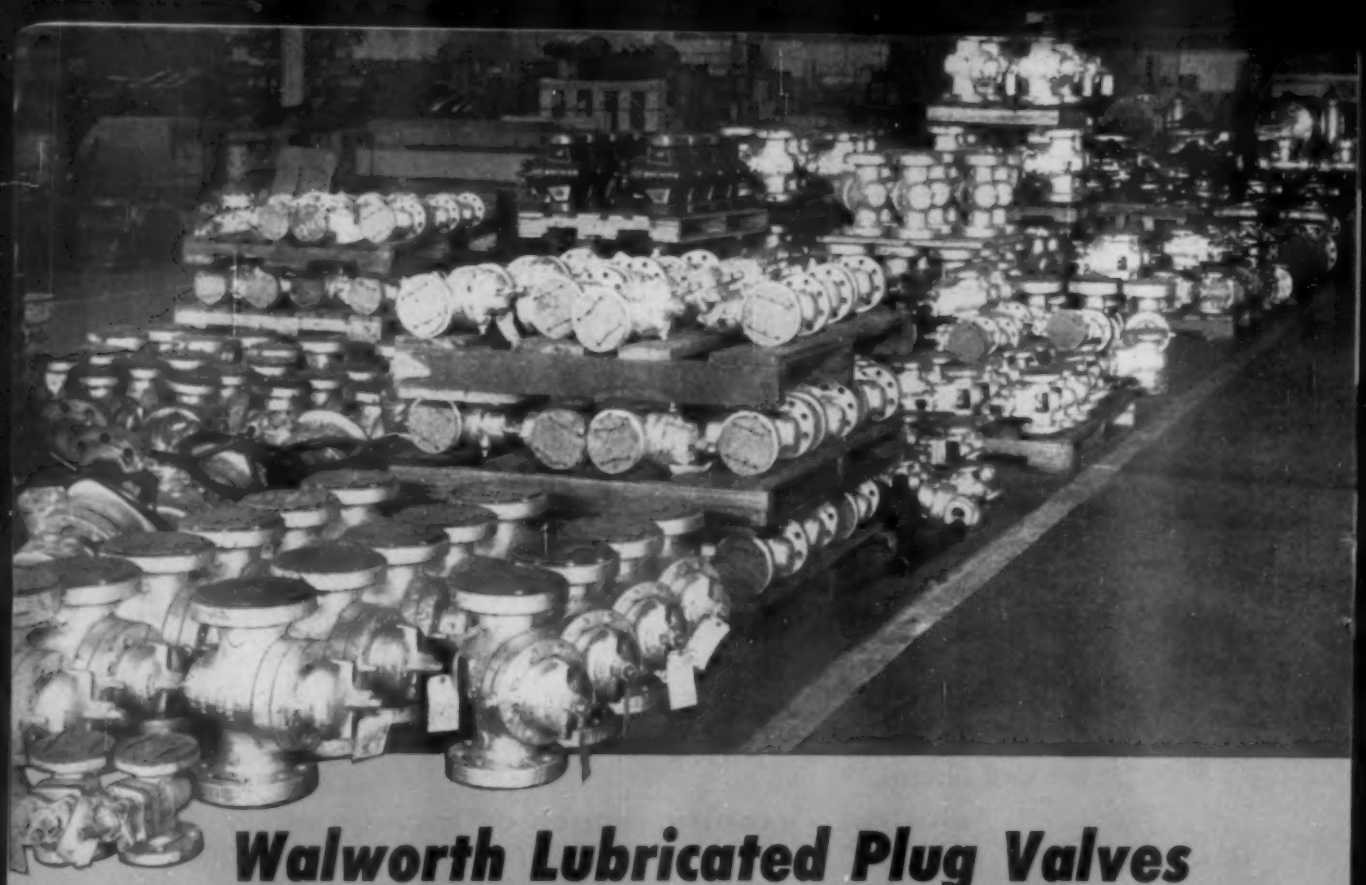

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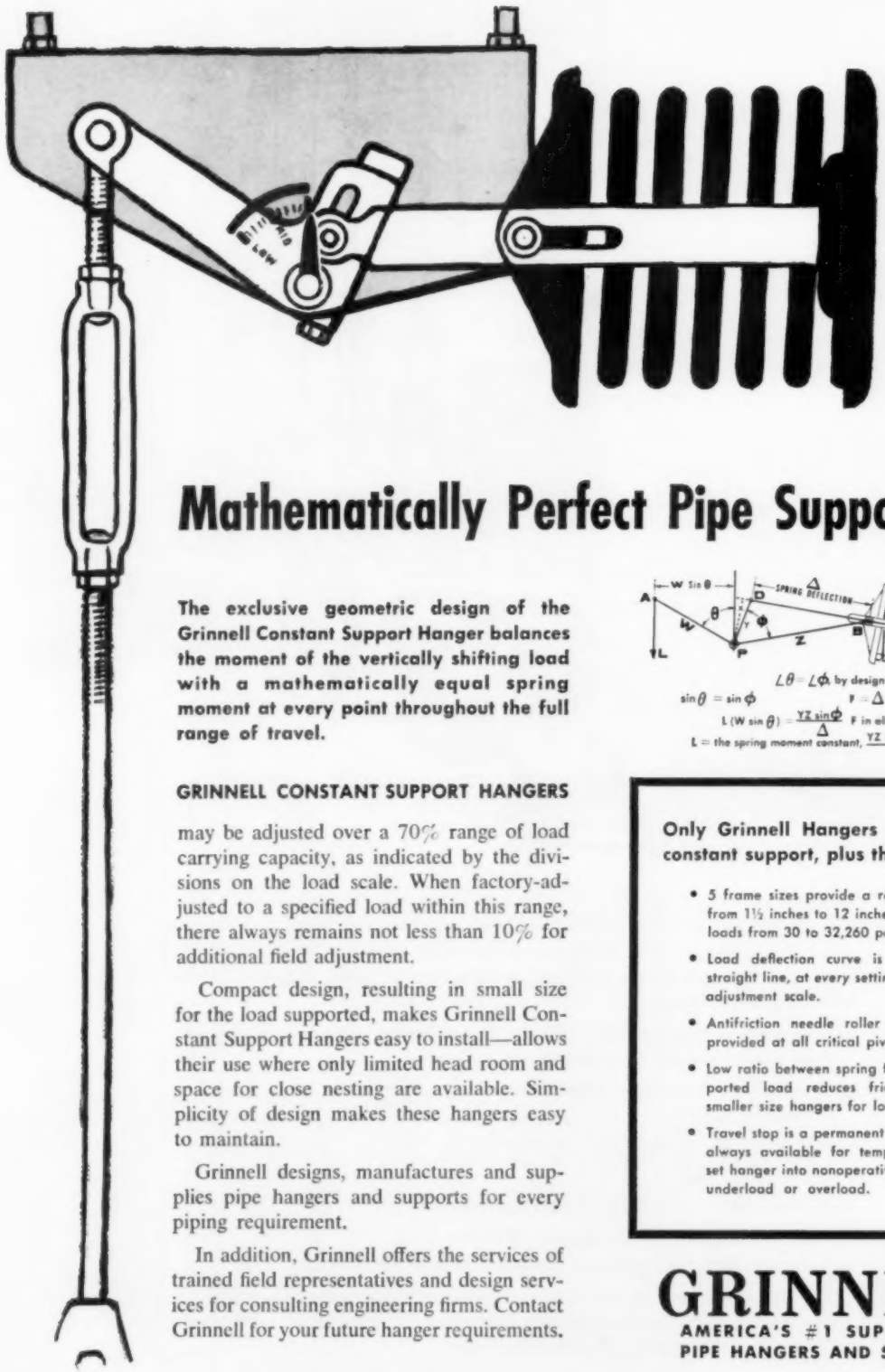

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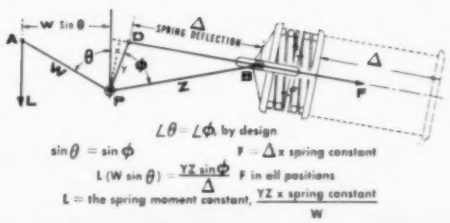

$\angle\theta = \angle\phi$ by design

$\sin\theta = \sin\phi$ $\quad F = \Delta \times$ spring constant

$L\,(W \sin\theta) = \frac{YZ \sin\phi}{\Delta} F$ in all positions

L = the spring moment constant, $\frac{YZ \times \text{spring constant}}{W}$

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may be adjusted over a 70% range of load carrying capacity, as indicated by the divisions on the load scale. When factory-adjusted to a specified load within this range, there always remains not less than 10% for additional field adjustment.

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Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

PRODUCTION PROTECTION with CONTROLLED CEMENTING

When you call for Halliburton Cementing Service, you get cements that are scientifically selected and tailored with additives that control the cement according to the specific conditions of your well. Scientific "know how" employed by experienced Halliburton cementers is aimed at providing the following advantages:

- protection and conservation of possible producing zones behind casing until they are ready to be tested or produced
- protection of formations against migratory subterranean fluids or high pressure gas zones
- protection of casing against corrosion

And reduces danger of

- contamination of valuable fresh water zones
- collapse of casing due to external pressure
- blowouts from high pressure gas zones behind the casing

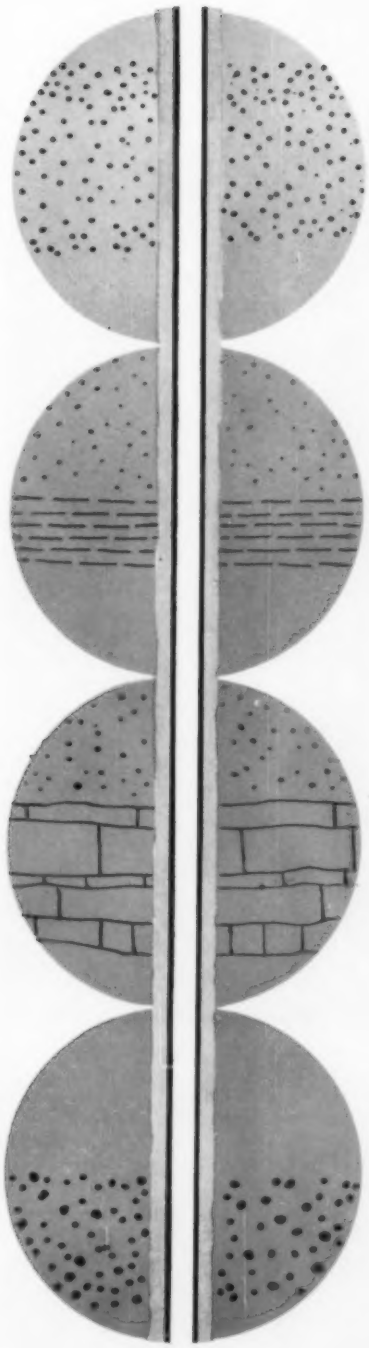
Greater experience in selecting and tailoring cements to your requirements helps Halliburton extend cementing protection for your well. Take advantage of this experience on your next cementing job.

HALLIBURTON

OIL WELL CEMENTING COMPANY DUNCAN, OKLAHOMA

HALLIBURTON'S POZMIX CEMENTS

CONTROL TIME—TEMPERATURE—PRESSURE



First introduced into oilfield use by Halliburton in 1949, Pozmix cements possess properties which make them superior to conventional portland cements. Pozmix cements are resistant to sulfate and salt water corrosion ... lower in cost ... easier to pump ... easier to perforate ... less permeable ... and more durable. Halliburton's laboratory developed accelerators, retarders, fluid loss and weight control additives provide precision control and excellent results for a wide range of primary and remedial cementing. Halliburton's Pozmix Cements include:

POZMIX CEMENT — ACCELERATED
Pozmix — Portland Cement — HA-5 Accelerator

- For surface pipe and shallow wells
- For low temperature conditions (40° to 100° F.)
- High early strength
- Shorter waiting-on-cement time

POZMIX CEMENT — REGULAR
Pozmix — Portland Cement Blend

- For intermediate or oil strings
- For moderate temperature conditions (80°-140° F.)
- High resistance to formation fluids
- Perforates, with less shattering
- Lighter slurry weight
- More economical than regular cement

POZMIX CEMENT — RETARDED
Pozmix — Portland Cement — HR-4 Retarder

- For oil strings
- For moderate to high bottom hole temperatures (140°-260° F.)
- Longer pumpability
- Combines with free lime in cement for less permeable product

POZMIX 140
Pozmix — Lime — Set Control Additives

- For long strings, liners and squeeze cementing
- For deep hot holes (140°-400° F +)
- Tailored to specific requirements
  Adequate pumping time
  Weighted for high pressures
- No strength retrogression
- Extremely economical

CEMENTING SERVICES

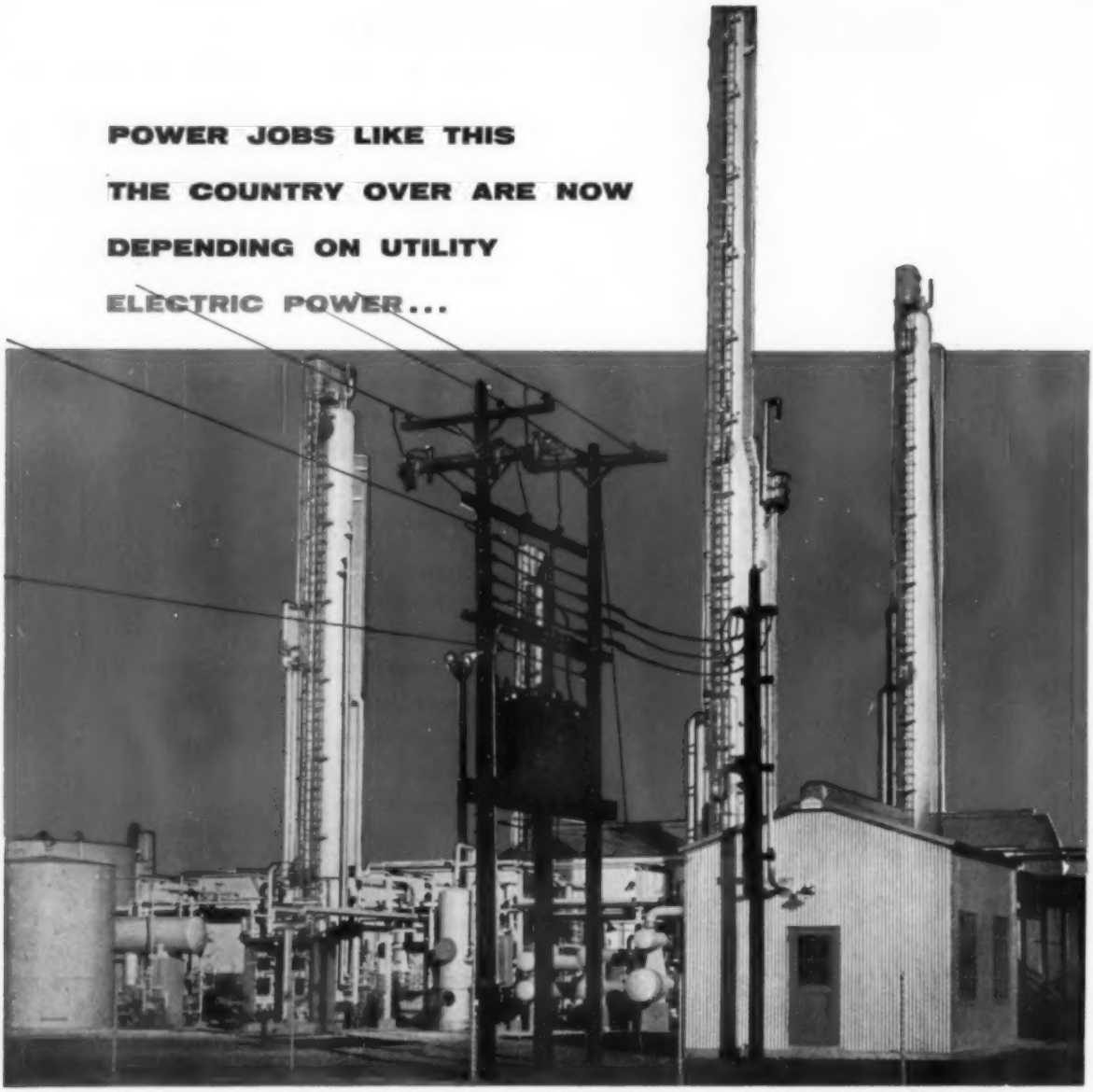
284 SERVICE CENTERS — JUST MINUTES AWAY FROM YOUR WELL

POWER JOBS LIKE THIS

THE COUNTRY OVER ARE NOW

DEPENDING ON UTILITY

ELECTRIC POWER...



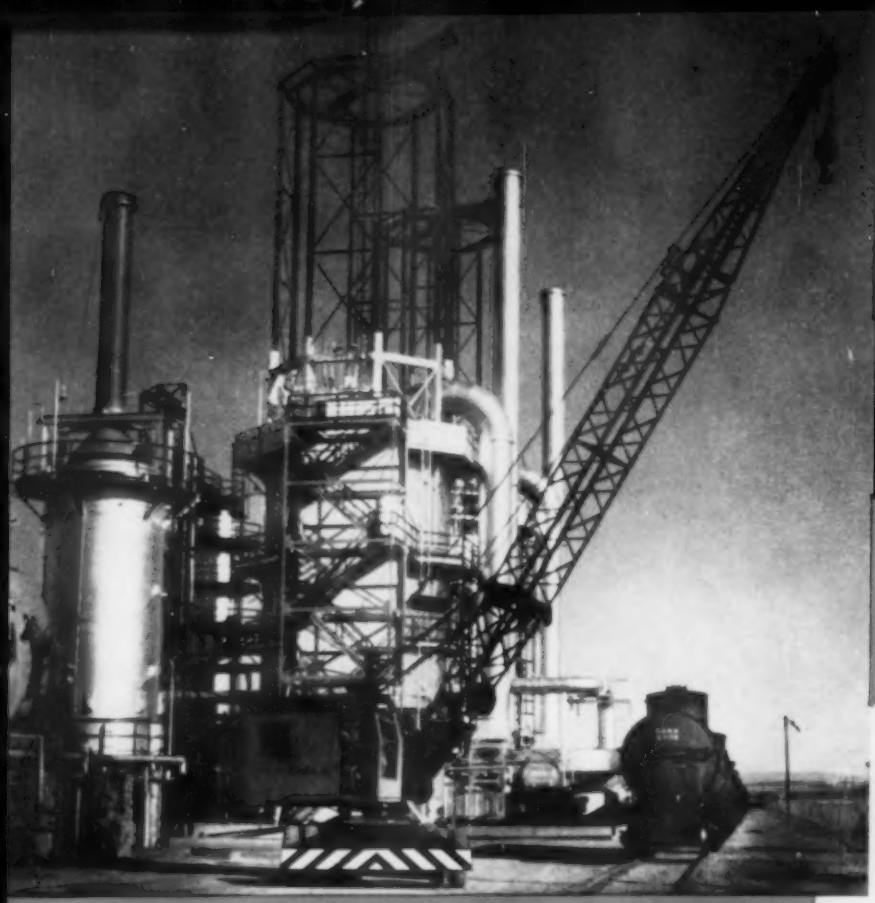
Progressive Management is taking a second look

One of the biggest expansions in refining operations is coming up. If you have any part in this important development don't let your company decide on power until the modern benefits of UTILITY ELECTRIC POWER have been carefully investigated. Call in the sales engineer of your Electric Service Company while your plant is in the planning stage. Convincing facts and helpful counsel are yours for the asking.

Be modern . . . Be progressive . . .
Use UTILITY ELECTRIC POWER.

PETROLEUM ELECTRIC POWER ASSOCIATION

P. O. BOX 35006 DALLAS, TEXAS



ALWAYS READY TO GO—

There is no more valuable quality in an Oilfield Crane!

NO OTHER single advantage in Northwest equipment has brought about so many repeat orders. *Your Northwest is always ready to go! We hear it everywhere and Northwest users will tell you so.*

Northwest Truck Cranes and Wagon Cranes have proved themselves particularly versatile around the refinery. Easy to handle—smooth in operation and fast—they solve the many lifting problems always present in refinery operation. The "Feather-Touch" Clutch Control gives you the true feel of the load. It makes operation easy by utilizing the power of the engine through a simple linkage to throw the heavy drum clutches. There are no compressors, no pumps, no tubing or other delicate mechanisms.

Uniform Pressure Swing Clutches eliminate the jerks and grabs that set a boom to jumping. They mean a smooth swing, accurate spotting of the load and greater safety. Rubber tire mounting means easy, fast travel around the plant or to outlying jobs at slush pits or to rigs. Easy convertibility assures fast changes to the proper equipment calling for Dragline, Shovel or Pullshovel.

This is just a small part of what these finer Northwest machines have for you. We would like to have you know more about Northwest equipment. A Northwest man will be glad to give you complete details or we will send you a catalog on the size machine you need.

NORTHWEST ENGINEERING COMPANY
1513 Field Bldg., 135 South LaSalle Street, Chicago 3, Illinois

NORTHWEST *Always Ready to* GO

NORTHWEST EQUIPMENT IS BUILT IN THE FOLLOWING SIZES

SHOVELS	CRANES	DRAGLINES	PULLSHOVELS	TRUCK CRANES
⅜ Yd. to 2½ Yd. Capacity	13-Ton to 50-Ton Capacity	⅜ Yd. to 3 Yd. Capacity	⅜ Yd. to 2½ Yd. Capacity	23-Ton and 28-Ton Capacity

T-41-9 IC

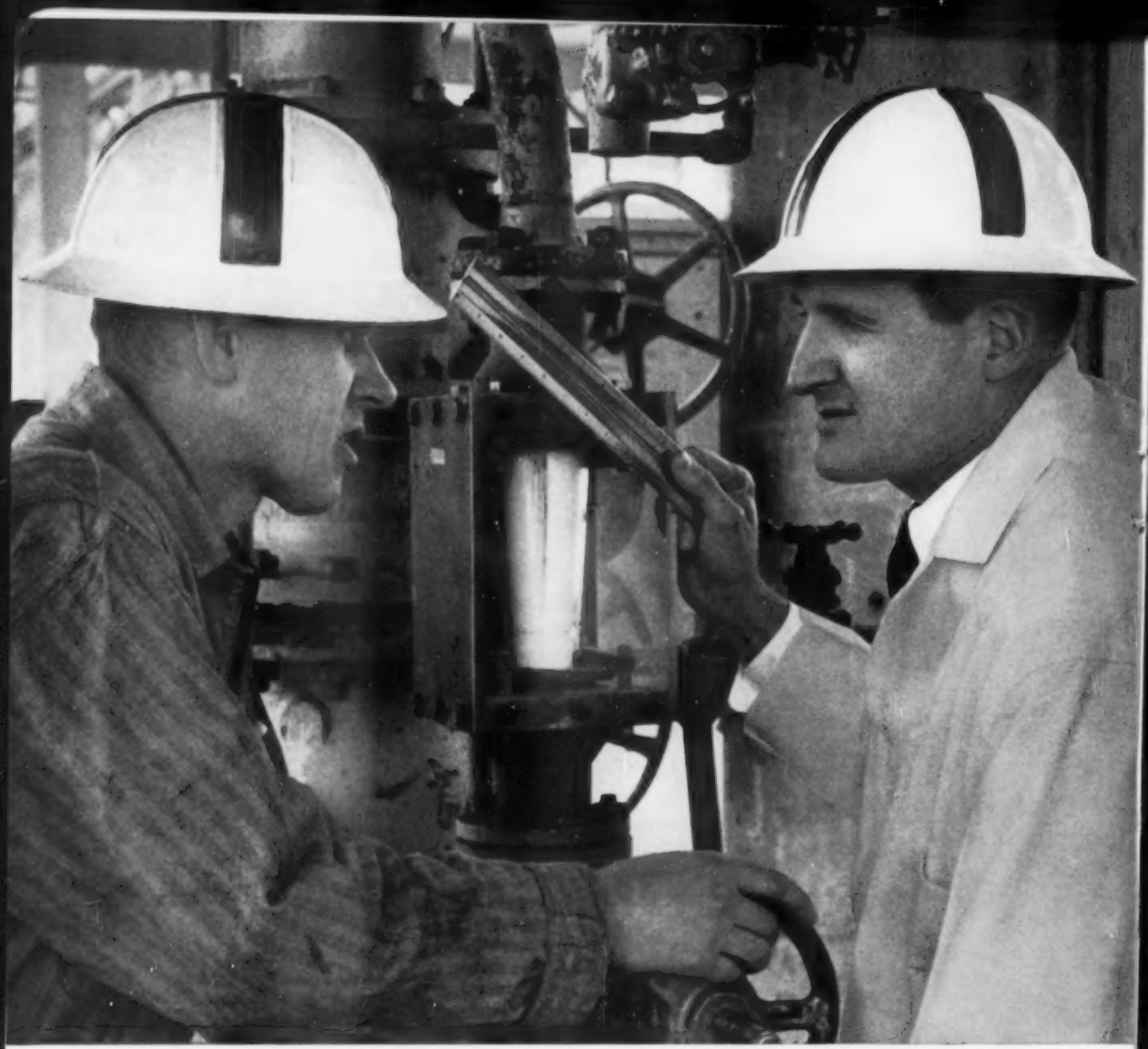


Photo taken at Delaware Refinery, Tidewater Oil Company

They feed the big cats

Feeding the big catalytic crackers takes close coordination of refining and chemical technology. Leading refiners and Cyanamid chemists worked together to pioneer the development of synthetic cracking catalysts, the first fully regenerative platinum reforming catalyst, the first high alumina catalyst.

Behind Cyanamid's service as a major catalyst producer are its unlimited resources as a major chemical producer.

Cyanamid's man with the golden rule can bring further progress through unique catalytic and chemical research and development facilities.

Basic in Catalyst Chemistry

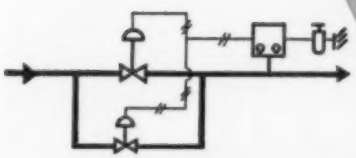
CYANAMID

AMERICAN CYANAMID COMPANY • REFINERY CHEMICALS DEPARTMENT • 30 Rockefeller Plaza, New York 20, N. Y.

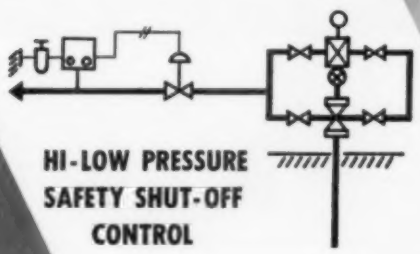
Originators of AEROCAT® Fluid Cracking Catalysts, AEROCAT TRIPLE A® High Alumina Catalysts, AEROFORM® Fluid Hydroforming and Platinum Reforming Catalysts, AERO® Specialty Catalysts, CYPAN® Drilling Mud Conditioner, AEROLUBE® Lubricating Oil Additives, AERONOX® Antioxidants, AEROSOL® Surface Active Agents

For Optimum Pressure Control, Specify BS&B 72-14 Pressure Controllers And Transmitters!

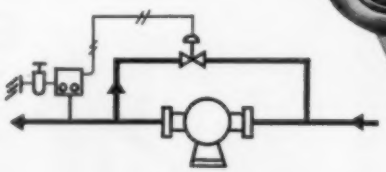
Proportional ★ On-Off ★ Differential Gap
Indicating Or Non-Indicating



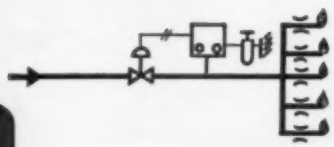
PRESSURE REDUCING CONTROL



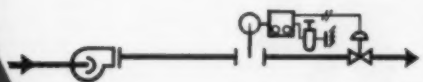
HI-LOW PRESSURE SAFETY SHUT-OFF CONTROL



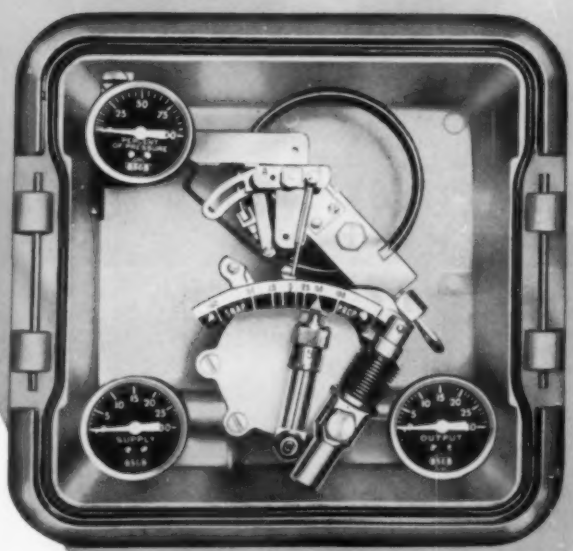
BACK PRESSURE CONTROL



LOW PRESSURE CONTROL



DIFFERENTIAL PRESSURE ...FLOW CONTROL



FEATURES OF POWER UNIT:

- Three-To-One High Capacity Relay
- Vibration Proof
- Push Button Cleanout
- Factory Calibrated Feed-Back Bellows
- Micrometer Adjustment

Ask Your BS&B Sales Engineer For Full Details, Or Write For Catalog 72-14.

OVER 60 YEARS BS&B ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

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Controls Division, Dept. 4-A5
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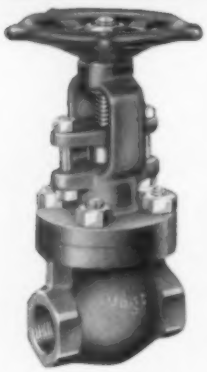


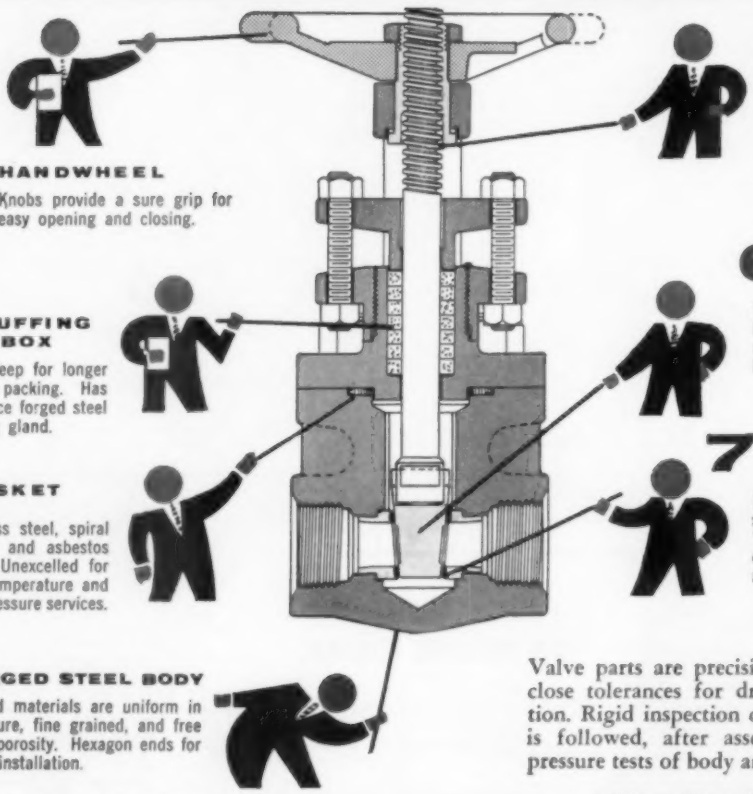
150-800 POUNDS SERVICE
2000 POUNDS COLD, W.O.G.
SIZES ¼" THRU 2"

A NEW Vogt

ROUND BOLTED BONNET, BOLTED GLAND

FORGED STEEL GATE VALVE

with 7 superior features



1 HANDWHEEL

Knobs provide a sure grip for easy opening and closing.

2 STUFFING BOX

Extra deep for longer life of packing. Has one-piece forged steel packing gland.

3 GASKET

Stainless steel, spiral wound, and asbestos filled. Unexcelled for high temperature and high pressure services.

4 FORGED STEEL BODY

Forged materials are uniform in structure, fine grained, and free from porosity. Hexagon ends for easy installation.

5 STEM

13% Chrome stainless steel. A special high melting point alloy yoke nut assures prolonged wear resistance.

6 WEDGE

13% Chrome stainless steel of approximately 500 Brinell for longer wear.

7 SEATS

13% Chrome stainless steel, hard faced with *HAYNES STELLITE or equivalent for stubborn resistance to seat wear.

Valve parts are precision machined to close tolerances for drop tight operation. Rigid inspection of finished parts is followed, after assembly, by final pressure tests of body and seats.

*Trade mark of Union Carbide Chemicals Co.

Address Dept. 24A-FO.

Vogt

GENERAL PURPOSE GP

Vogt FOR BETTER VALVES

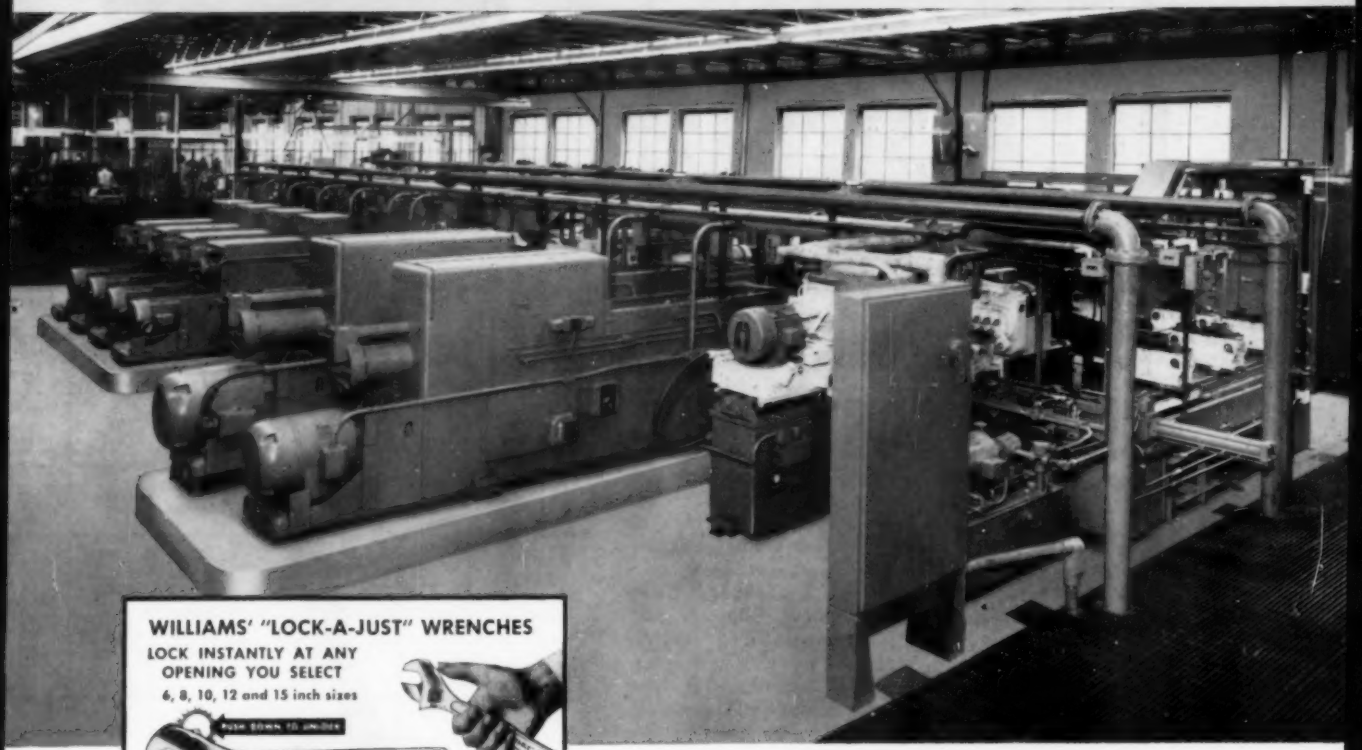
HENRY VOGT MACHINE COMPANY, Louisville, Ky.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Camden, N. J., St. Louis, Charleston, W. Va., Cincinnati.

DROP FORGED STEEL

VALVES

WILLIAMS... First and Only Manufacturer to Use Million Dollar Automated Equipment to Produce Higher Quality Adjustable Wrenches in Volume



WILLIAMS' "LOCK-A-JUST" WRENCHES

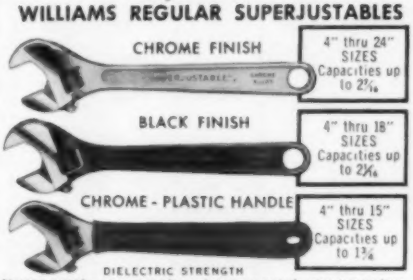
LOCK INSTANTLY AT ANY OPENING YOU SELECT

6, 8, 10, 12 and 15 inch sizes

CHROME OR BLACK FINISH

COVERED BY U.S.A. PATENT 2719449

WILLIAMS REGULAR SUPERJUSTABLES


CHROME FINISH
4" thru 24" SIZES Capacities up to 2 7/16
BLACK FINISH
4" thru 18" SIZES Capacities up to 2 1/4
CHROME - PLASTIC HANDLE
4" thru 15" SIZES Capacities up to 1 3/4

DIELECTRIC STRENGTH (SHORT TIME)—400 VOLTS/MIL. (STEP BY STEP)—285 VOLTS/MIL.

ALL WILLIAMS ADJUSTABLE WRENCHES ARE DROP-FORGED FROM SELECTED ALLOY STEEL AND HEAT-TREATED.

HERE, AT WILLIAMS, is the most advanced method used in machining adjustable wrenches. This completely automated transfer machine performs 21 precision operations with unparalleled accuracy. Its performance exceeds all existing standards — to provide you with adjustable wrenches of unmatched quality . . . in quantity.

Retaining all exclusive features which have made them first choice in feel, fit and finish — Williams Adjustable Wrenches now are an even better value at no greater cost than you would pay for ordinary adjustable wrenches.

FOR PROMPT, PERSONAL SERVICE

INDUSTRIAL DISTRIBUTORS — SERVING INDUSTRY ECONOMICALLY — THE RIGHT HAND OF PRODUCTION

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WILLIAMS DROP FORGED

TOOLS OF INDUSTRY

J. H. WILLIAMS & CO.

415 VULCAN STREET

BUFFALO 7, NEW YORK

UNIBOLT
flow manifolds

fit your pressures as well as your pocketbook

These are the Christmas tree manifolds that are custom-built to any operator's flow control needs, but at no premium in price. Unlike manifolds of fixed design, UNIBOLT permits complete flexibility in arrangement of its units. Components may have threaded, flanged or UNIBOLT connections. They may be of malleable, regular steel, alloy or SA* stainless, depending upon pressures and service. The chokes may be adjustable or positive with interchangeable flow-rated beans or X-beans. Tee type for single wing or cross type for double wing trees are available. Select exactly what you need for the well. Later on you may salvage the entire manifold as a unit or as individual parts for use elsewhere. By any yardstick, UNIBOLT Flow Manifolds give you far more desirable features . . . at a reasonable cost.

*Special Analysis

10,000 Lb. WP — Alloy Steel or SA* Stainless

5,000 Lb. WP — Alloy Steel or SA* Stainless
3,000 Lb. WP — Carbon Steel or SA* Stainless

3,000 Lb. WP — Carbon Steel or SA* Stainless
5,000 Lb. WP — Alloy Steel or SA* Stainless

3,000 Lb. WP — Carbon Steel or SA* Stainless
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Mathieson

Mathieson ethanolamines are produced and shipped in accordance with your operating requirements. They are available in tank car,

mono–
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ETHANOLAMINES

tank truck and drum lots, directly from our modern organic chemicals plant in Brandenburg, Kentucky; and in tank trucks and drums, from large local stocks, through conveniently located distributors in key industrial areas.

Whatever your prime requirement... high quality, ready availability, technical service...for ethanolamines, contact your Olin Mathieson representative. Write today for further information and data sheets.

Polyamines
Ethanolamines
Ethylene Oxide
Ethylene Glycol
Ethylene Diamine
Diethylene Glycol
Triethylene Glycol
Dichloroethylether
Ethylene Dichloride
Surfactants (Poly-Tergents)
Polyethylene Glycols (Poly-G's)
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Poly-G, Poly-Solv and Poly-Tergent are registered trademarks.

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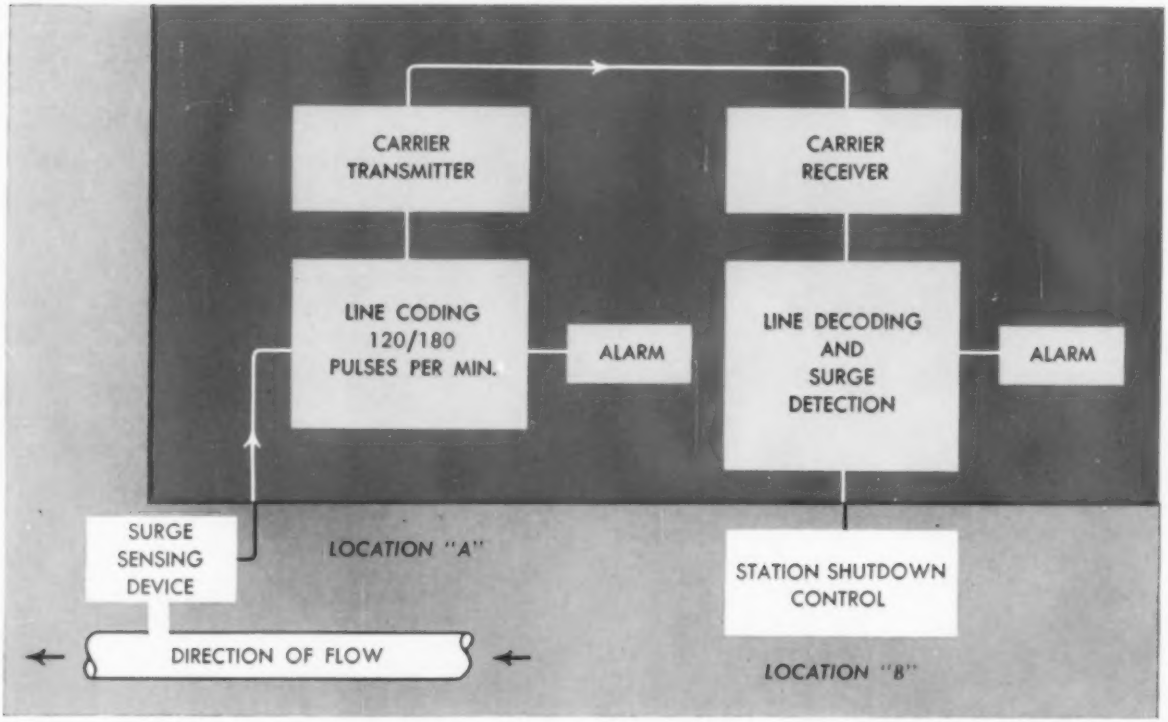


New! Union Surge-Purger

protects your pipeline from blowouts

PIPELINES ARE GETTING OLDER. Pumping stations are steadily being added to increase capacity. As a result, stresses on pipeline systems are becoming acute and blowout protection is needed. Union Switch & Signal has the answer—a new protection system that automatically detects surges and acts to stop them.

AUTOMATIC SHUTDOWN

The schematic diagram of the Union Surge-Purger Control System is shown above. Normally the equipment at Location B receives a steady 120-cycle code.

A severe surge causes this code to change to a 180-cycle "shutdown" code. The station shutdown equipment responds *only* to this special shutdown code, immediately acts to shut down the pump upstream from the point where the surge was detected.

If the "normal" 120-cycle code is upset by noise or equipment failure, an alarm indicates this situation. But only a surge can cause a shutdown.

SIMPLE AND RELIABLE

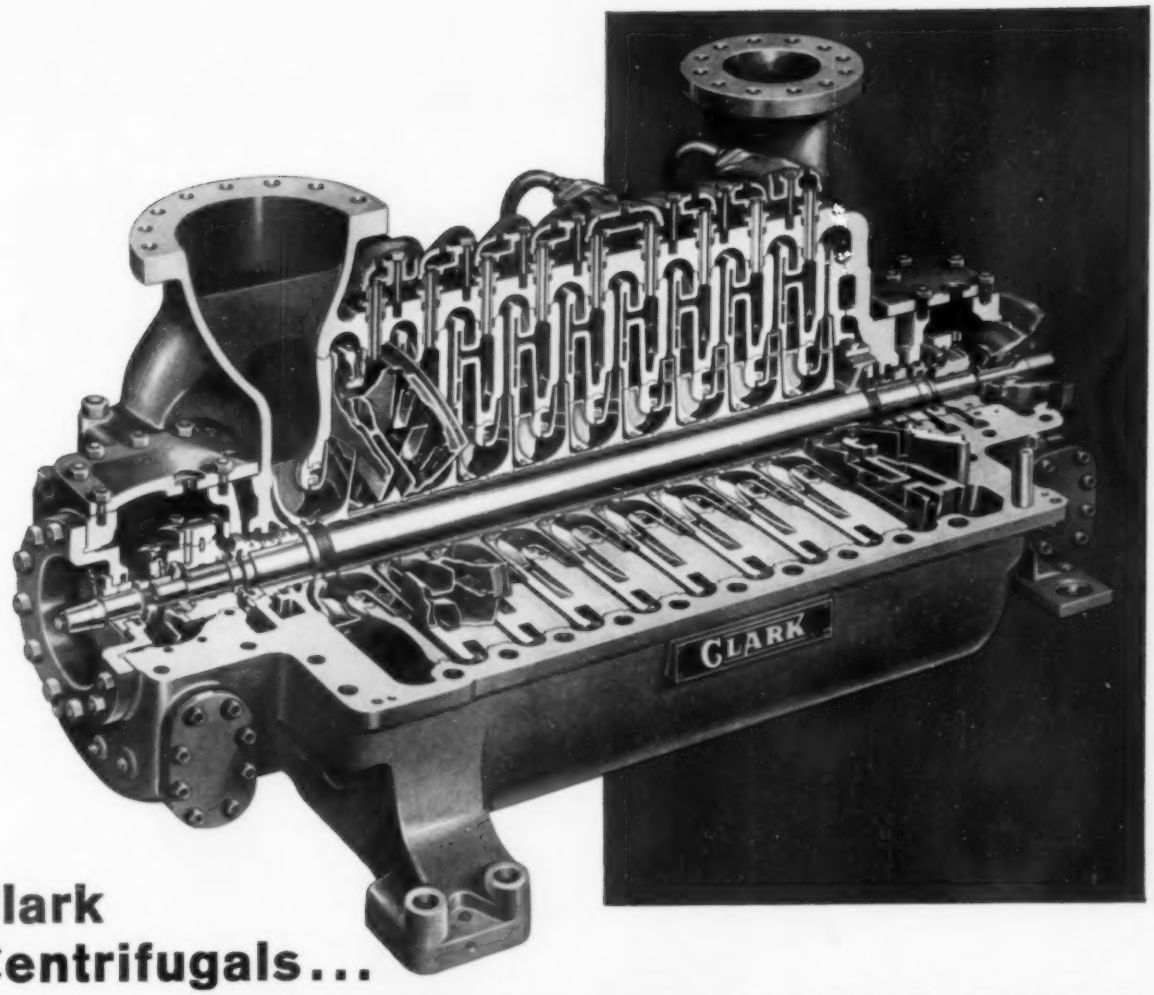
Practically no maintenance is required by this rugged all-relay control system. It will operate reliably for extremely long periods of time. Its dependability and self-monitoring features make it as foolproof as any control can be. This system is working to the complete satisfaction of leading pipeline companies in surge detection problems. Write to learn how it can help you.

"Pioneers in Push-Button Science"

UNION SWITCH & SIGNAL

DIVISION OF WESTINGHOUSE AIR BRAKE COMPANY

PITTSBURGH 18, PENNSYLVANIA



Clark Centrifugals...

PROVED DESIGN

gives higher compression ratios with built-in alignment at conservative speeds

Clark centrifugal compressor design with bearing supports cast integral with the case provides permanent alignment for the life of the compressor. This permits the use of up to 10 impellers in a single case without compromising safety. As a result, you get higher compression ratios at conservative speeds. This performance has been field-proved at every installation.

This design provides sufficient area to permit the use of any seal including the Clark pressure oil film type seal between the gas stream and the bearings.

In addition to a complete line of multi-stage centrifugals, Clark also builds a gas turbine to drive many of them. Design and performance of every Clark machine stems from Clark's encyclopedia of experience. Call your nearest Clark representative for all the facts. Or write today for Bulletin 150 to Clark Bros. Co., 1102 Lincoln Avenue, Olean, New York.

CLARK BROS. CO.

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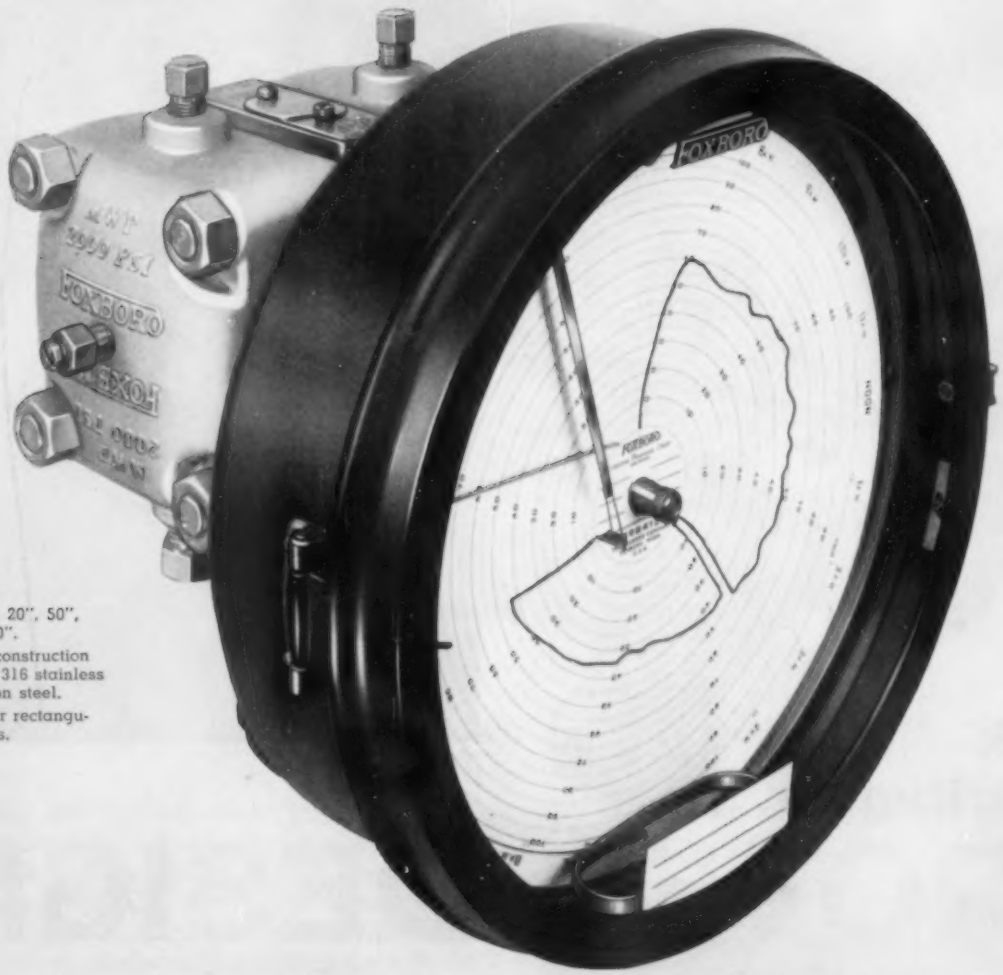
Sales and service outlets in principal cities throughout the world

CLARK®

CENTRIFUGAL COMPRESSORS • GAS TURBINES

NOW... a "Dry" Flow Meter with..

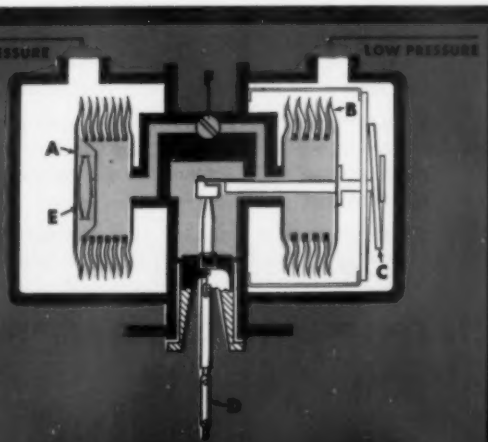


- Ranges: 20", 50", 100", 200".
- Forged construction in Type 316 stainless or carbon steel.
- Round or rectangular cases.

...the new Foxboro Type 37 Diaphragm Meter

How It Works

In schematic drawing at right, areas shown in color represent a stable, non-freezing liquid. Any pressure increase in the high pressure chamber compresses Diaphragm Unit A, displacing its liquid and expanding Diaphragm Unit B until force of Range Spring C equals the difference between the forces on Diaphragm Units A and B. Linear motion of Diaphragm Unit B moves inner end of Drive Bar D — outer end moves correspondingly through the bellows-sealed flexure bar, driving pen arm. Built-in Temperature Compensator (E) proportionately adjusts diaphragm capacity as ambient temperature variations affect volume of filling fluid. External damping adjustment is shown at F.



•complete overrange protection!

•sustained high accuracy!

Now you can have mercuryless flow measurement for a wide range of differential pressures — at static pressures up to 2000 psi — with greater safety and dependability than ever before!

The new Foxboro Type 37 Diaphragm Meter not only combines unmatched ruggedness and precision in a dry meter — it's by far the easiest to adjust and maintain. And it does away with zero drift problems, once and for all!

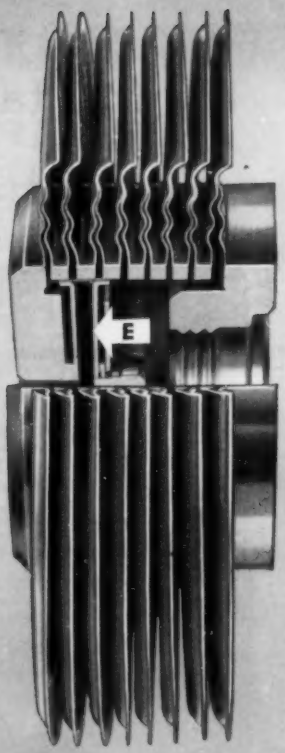
Expansible, Type 316 S.S. diaphragm elements respond to changes in pressure with unmatched sensitivity, yet are completely immune to overrange up to full static pressure! A unique packless drive bar precisely transmits linear motion to the pen arm. Range-changing is easy, due to new twin-spiral spring design. Wide range damping is externally adjustable under pressure. And the Type 37 is self-compensating for temperature changes in all differential ranges.

Get full details on this high utility, completely dependable dry flow meter. Arrange for a demonstration with your nearby Foxboro Field Engineer, or write **The Foxboro Company, 605 Neponset Ave., Foxboro, Mass., U.S.A.**

FOXBORO

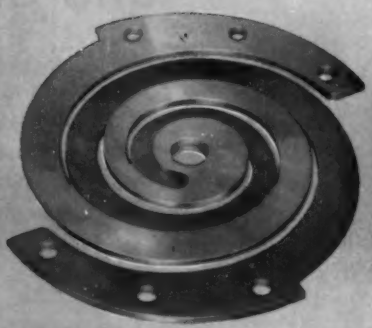
REG. U.S. PAT. OFF.

FIRST IN FLOW METERING



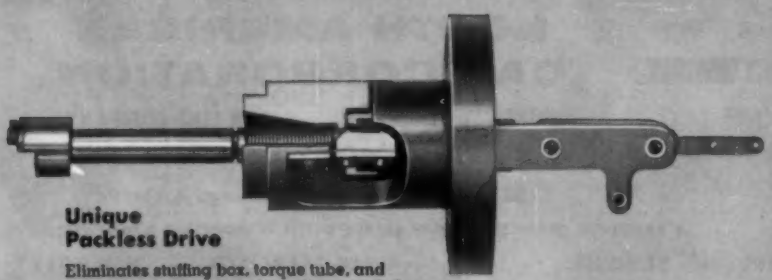
Exclusive Diaphragm Elements

Type 316 S.S. diaphragm units in both high and low pressure chambers provide greatest linearity and freedom from hysteresis; nesting design and integral spacer rings provide safe, positive, overrange protection. Temperature compensation (E) is built into diaphragm assembly . . . never requires change or adjustment.



Exclusive Range Springs

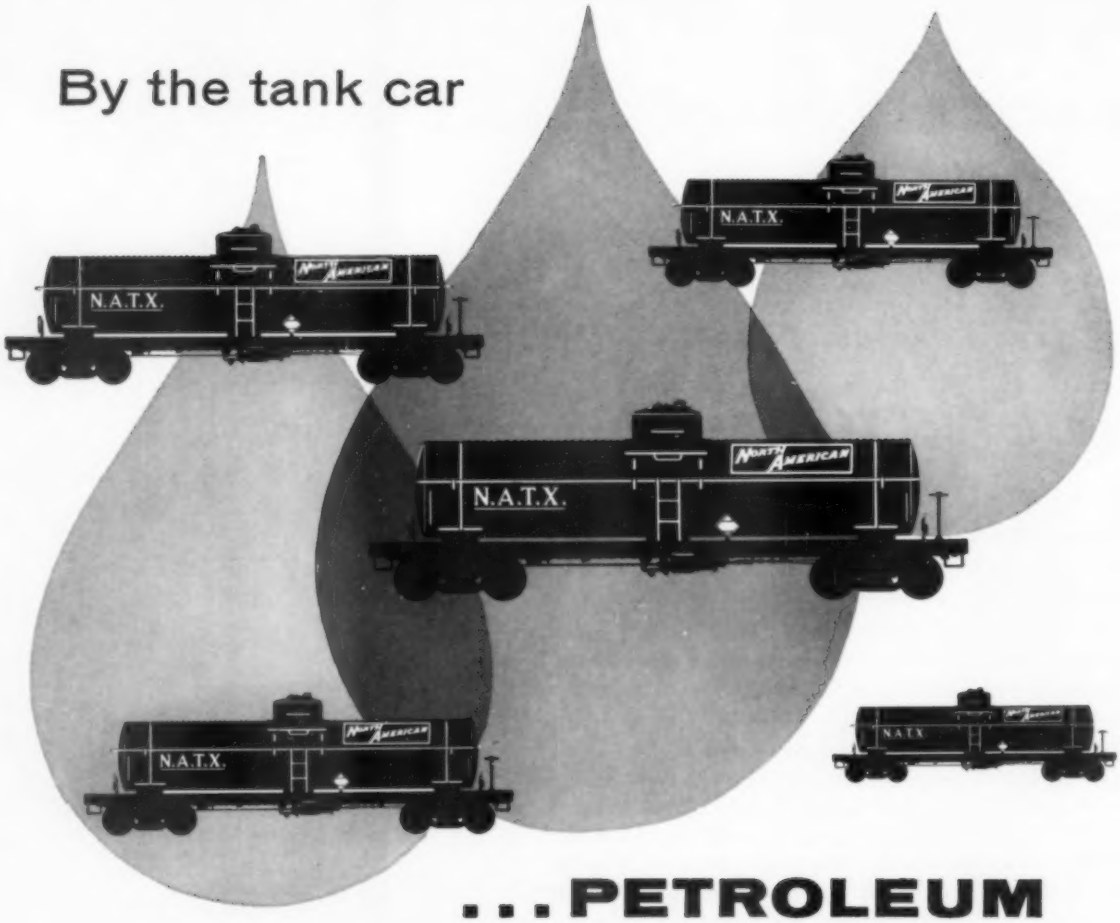
Heavy gauge Ni-Span C alloy, twin-spiral springs provide high sensitivity with lasting accuracy. Readily accessible . . . range changes are easily made, in minutes!



Unique Packless Drive

Eliminates stuffing box, torque tube, and bearings. Flexure-pivoted, bellows-sealed drive bar transmits diaphragm's linear motion to the pen arm with unequalled sensitivity *and undiminished* power. Seal for flexure pivot is a tough, flexible bellows.

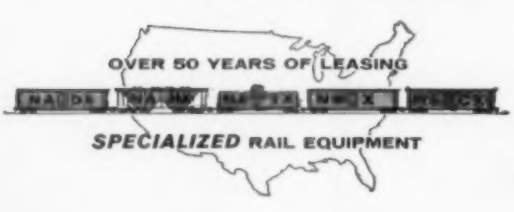
By the tank car



...PETROLEUM FOR YOUR CUSTOMERS

and plenty of goodwill for you!

Your North American tank cars are where you want 'em, when you want 'em . . . kept on the move by nine big repair and conditioning shops for dependable service. When you lease our equipment, you're assured of a continuous car supply for better planning, improved shipping, more satisfied customers. Your transportation needs are our business. If we haven't the cars you need, we'll be glad to build you special ones . . . and then lease them to you.



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NORTH WESTERN REFRIGERATOR LINE COMPANY
MATHERS HUMANE STOCK TRANSPORTATION COMPANY

231 South LaSalle Street, Chicago 4, Illinois

A NATIONWIDE ORGANIZATION WITH BRANCH OFFICES IN IMPORTANT MARKET CENTERS

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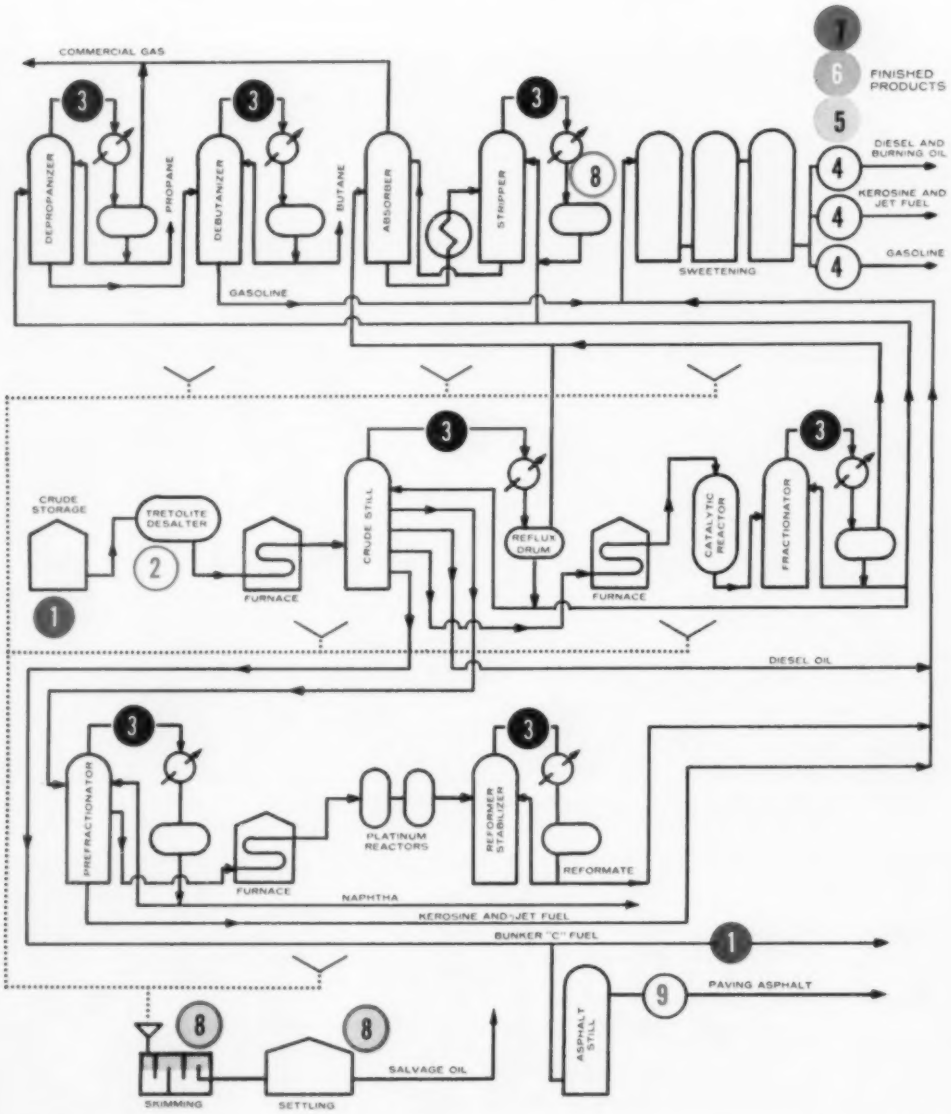
TRETOLITE PRODUCTS

offer you 9 ways to INCREASE and IMPROVE refinery production

1. **TRET-O-LITE** Demulsifiers
2. **TRET-O-LITE** Desalting
3. **KONTOL** Corrosion Inhibitors
4. **KONTOL 77** for Products Lines
5. **KUPLEX** Metal De-activators
6. **TOLAD** Fuel Oil Additive
7. **FEP Fuel Oil** Emulsion Preventive
8. **TRET-O-LITE** Water De-Oilers
9. **DEHYDRO** Asphalt Additives



TRETOLITE COMPANY

DIVISIONS OF PETROLITE CORPORATION

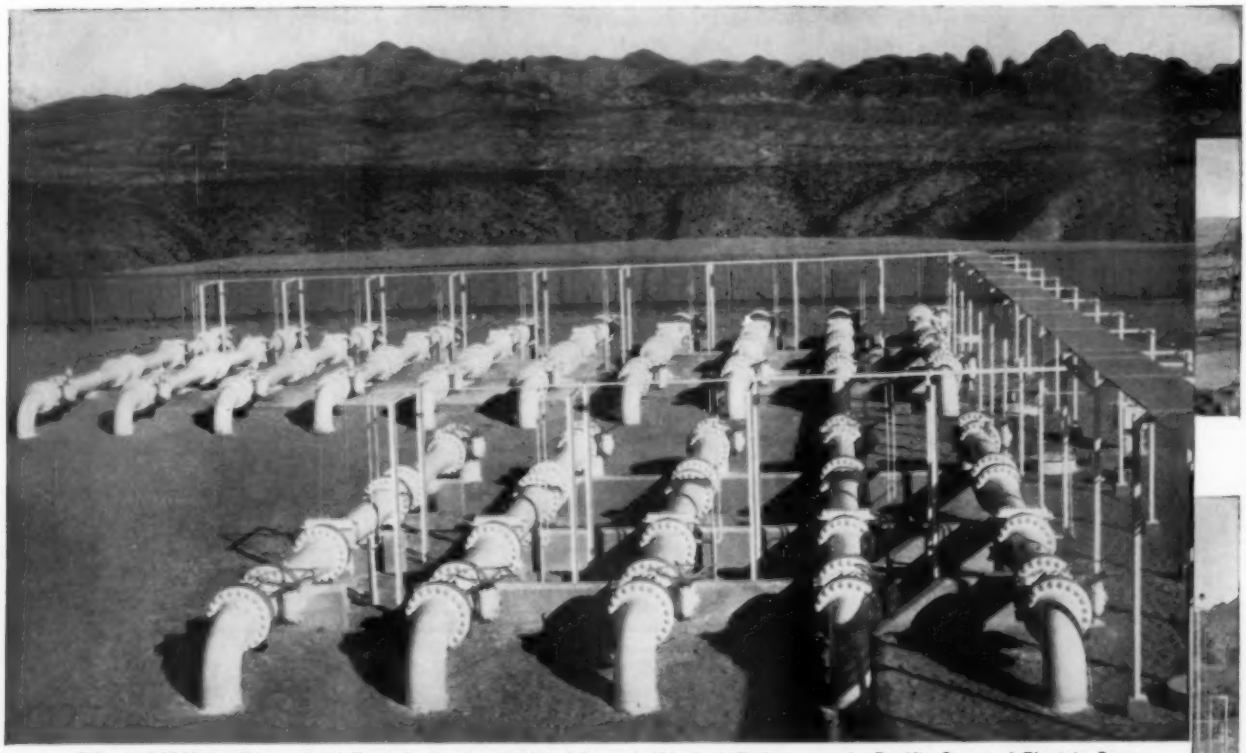
369 Marshall Avenue, Saint Louis 19, Missouri • 5515 Telegraph Road, Los Angeles 22, California

Chemicals and Services for the Petroleum Industry

DESALTING • CORROSION INHIBITING • DEMULSIFICATION • SCALE PREVENTION • WATER DE-OILING
METAL DEACTIVATION • ADDITIVES

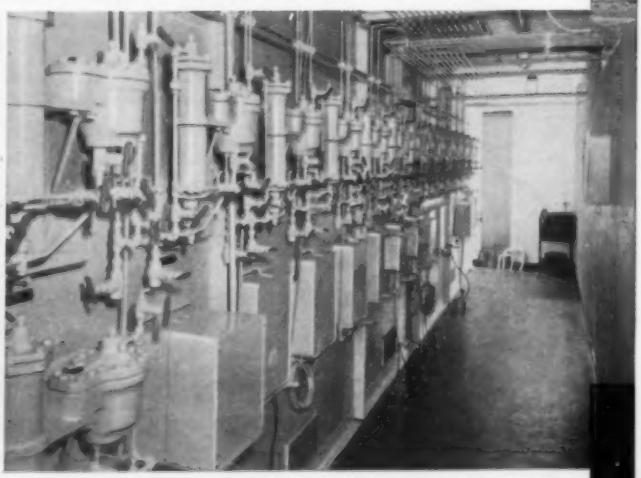
AR-58-2

Topock... where



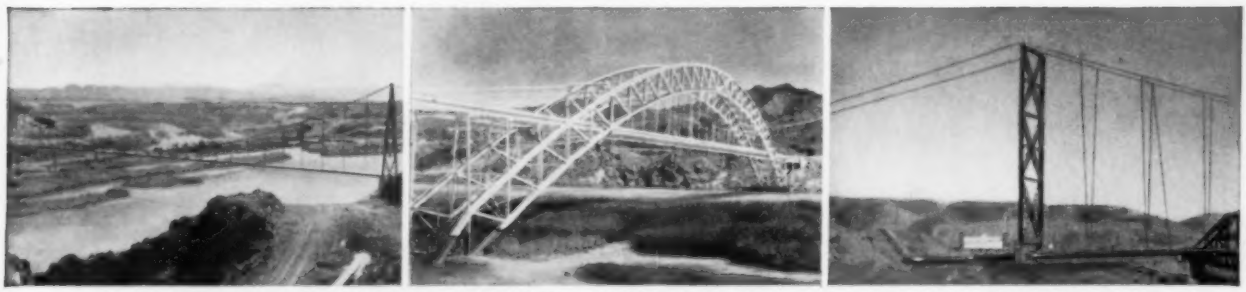
Fifteen 16" Meter Runs are at Topock. Gas transmitted through this installation goes to Pacific Gas and Electric Company, Southern Counties Gas Company, Southern California Gas Company and Nevada Natural Gas Company.

Instantly Available to dispatchers at all times, are readings from the American Orifice Meters on the panel board. Charts are changed daily and mailed to a central point for integrating and billing.

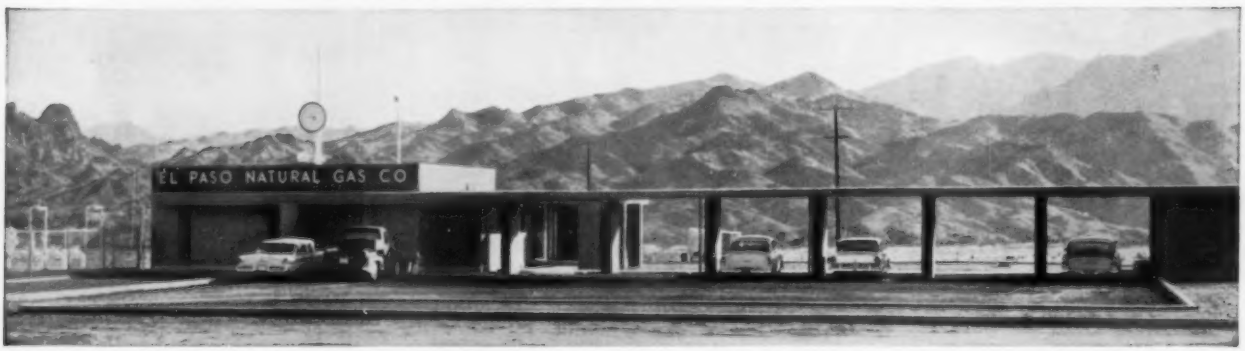


American Orifice Meters on back of panel board are A-20's. 100 inch range mercury manometers are designed for operation up to 1800 psi working pressure.

American® meters measure nearly 1½ billion cu. ft. of gas per day



Topock Means Bridge in Indian language. These three 1,000 foot bridges carry two 30" and one 34" pipe line across the Colorado River for transmission to California. The natural gas in each aerial line weighs about six tons.



At Topock, Arizona, on the banks of the Colorado River, almost one and one-half billion cubic feet of natural gas a day, piped across the desert from New Mexico, Colorado and Texas, are mixed to supply the uniform BTU natural gas for the growing needs of California and Nevada. Metering and control is effected at this ultra-modern air-conditioned desert station. Because of the immense volume of gas measured at this point, minute errors could result in losses amounting to hundreds of dollars a day.

Here, fifteen American Orifice Meters, each capable of measuring and recording 100 million cubic feet of gas a day at 500 psi, provide the sustained accuracy required, for measuring the largest volume of gas flowing through any metering station today.

American Meter engineering assistance, and American precision equipment are available for every measurement and control problem. *Call* or *write* your nearest American Meter Company representative.

AMERICAN METER CO.

AMERICAN® METER COMPANY

INCORPORATED (ESTABLISHED 1836)

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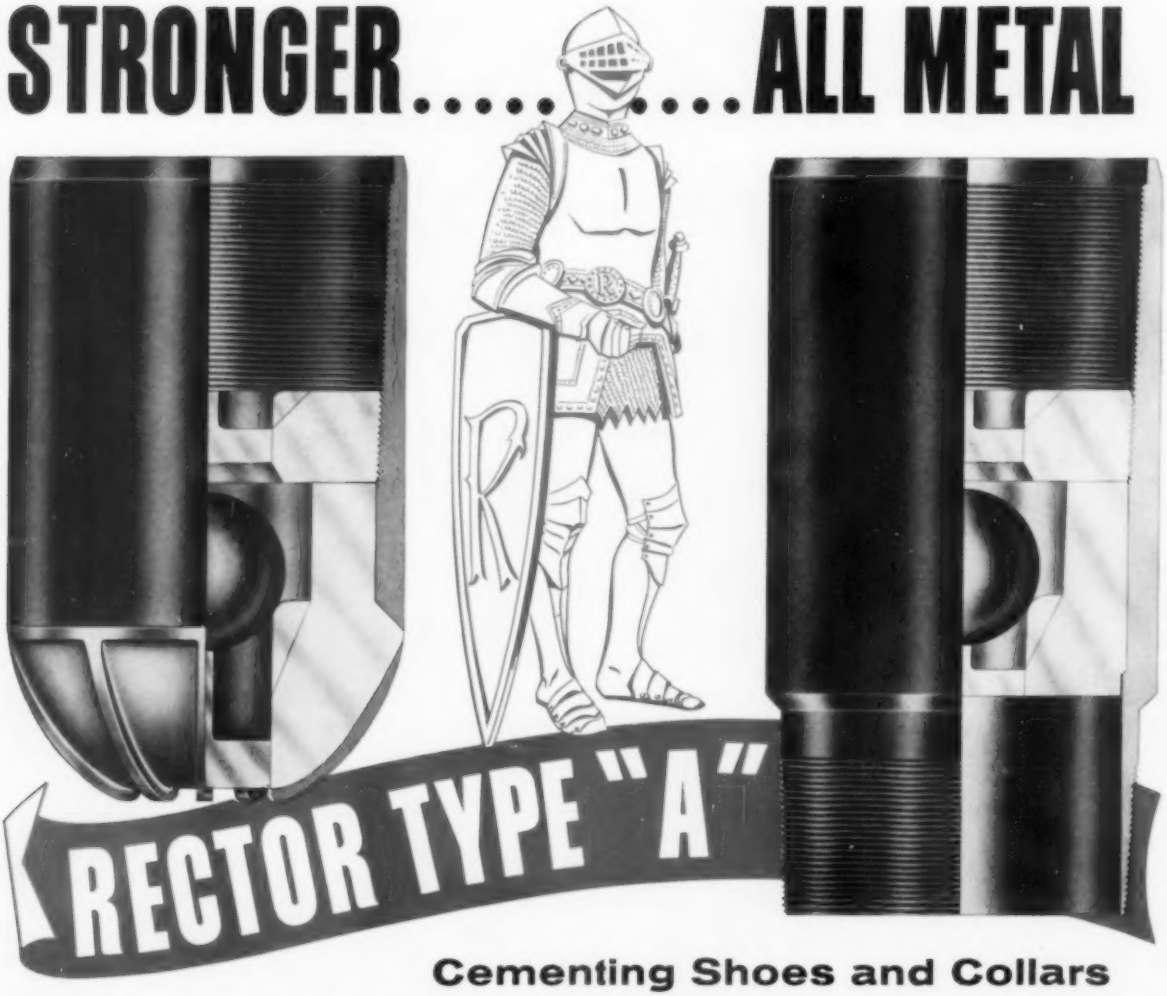
SUPPLIERS TO THE GAS INDUSTRY for Ironcase, Tinned Steelcase, Aluminumcase and Welded Steelcase Meters • American-Westcott Orifice Meters • Instruments • Reliance Regulators • Apparatus • Valves

STRONGER.....ALL METAL



Cementing Shoes and Collars

Precision made for a good cementing job every time!

Rector Type "A" Shoes and Collars are precision machined from high quality seamless steel with internal parts of a special high strength ALUMINUM ALLOY that is readily DRILLABLE. Not only is the ALUMINUM ALLOY far stronger than concrete or bakelite, but is machinable to close tolerances for precision fabrication.

Internal parts are quickly drillable, as there is a minimum of material to be drilled out.

Bullet nose permits the shoe to guide smoothly past ledges and obstructions.

For economical, trouble-free cement jobs, always ask for Rector Type "A" equipment at your favorite SUPPLY STORE.

Stocked by supply stores in casing sizes 4½" O.D. to 13⅜" O.D.

EXPORT DISTRIBUTORS:
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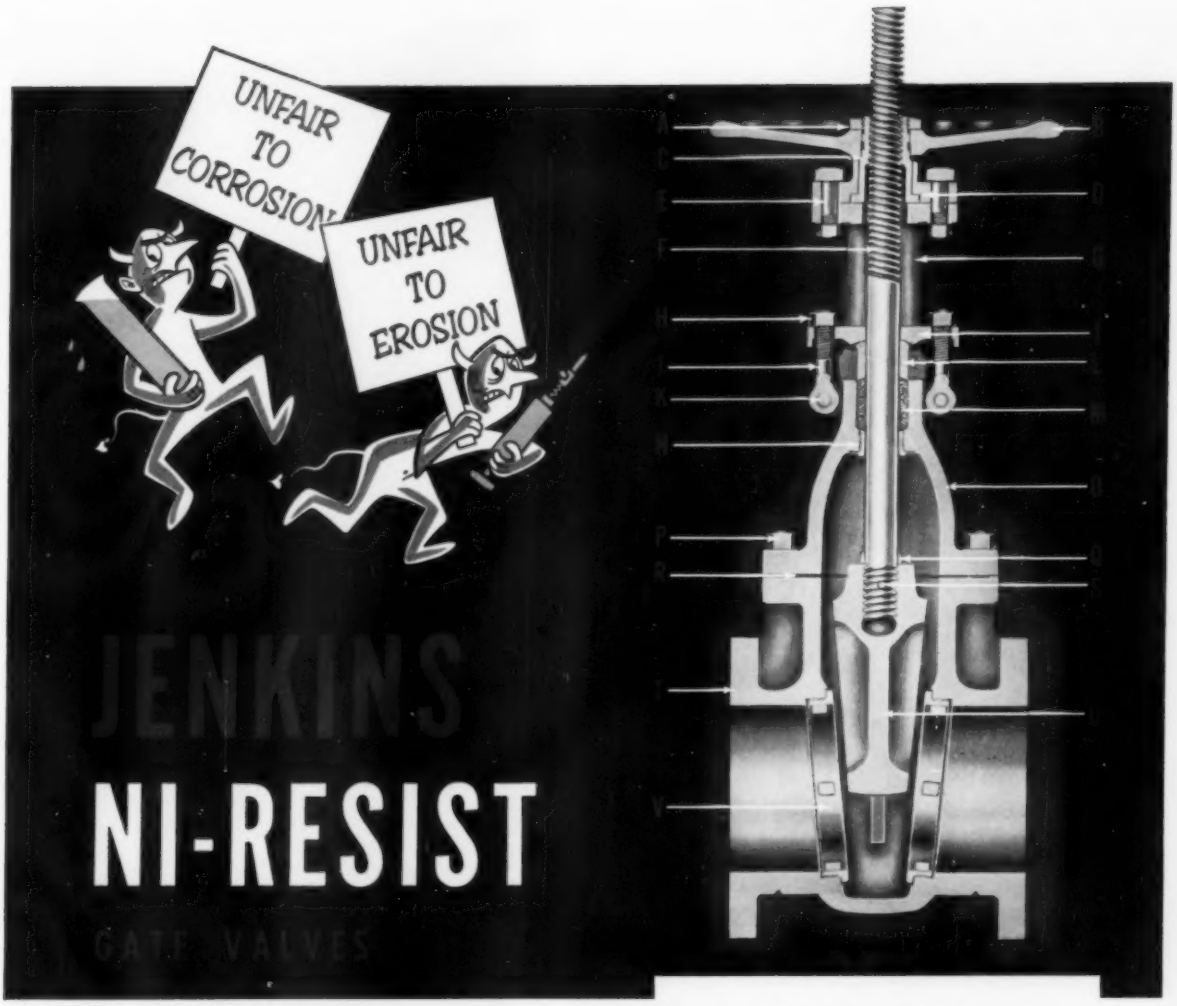
REPRESENTATIVES IN ALL ACTIVE FIELDS



Wherever valves are attacked by acids, salt and alkaline solutions, sea water, brine or other corrosive fluids, vapors or gases, "Jenkins Ni-Resist Gate Valves" are *fighting* words.

In a wide range of corrosive and erosive services common to the chemical, food, plastics, marine, petroleum, and pulp and paper industries, these valves have shown a remarkable ability to withstand corrosion and cut valve costs.

The secret of their long, trouble-free service is the combination of Ni-Resist type 2 cast iron and type 316 stainless steel trim, plus Jenkins *extra value* construction throughout. No other gate valves offer this combination for fighting corrosion.

When choosing Ni-Resist valves, let the famous Jenkins Diamond be your guide. Specify "JENKINS NI-RESIST" — for longer valve life. Write us, or ask your Jenkins Distributor for information folder No. 205. Jenkins Bros., 100 Park Avenue, New York 17.

A Bronze yoke bushing nut
B Handy grip iron wheel
C Bronze yoke bushing
D Iron yoke cap with zerk fitting for lubricating bushing
E Steel yoke cap bolts and nuts
F TYPE 316 STAINLESS STEEL spindle
G NI-RESIST CAST IRON, TYPE 2, yoke
H Bronze eye bolt nuts
I Malleable iron gland flange
J Steel gland eye bolts
K Steel gland lug bolts and nuts
L TYPE 316 STAINLESS STEEL gland
M Teflon impregnated asbestos packing
N TYPE 316 STAINLESS STEEL bonnet bushing
O NI-RESIST CAST IRON, TYPE 2, bonnet
P Steel bonnet bolts and nuts
Q TYPE 316 STAINLESS STEEL spindle ring
R Asbestos gasket
S TYPE 316 STAINLESS STEEL wedge pin
T NI-RESIST CAST IRON, TYPE 2, through-port body
U TYPE 316 STAINLESS STEEL solid I-beam wedge
V TYPE 316 STAINLESS STEEL seat rings

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VALVES
JENKINS
SINCE 1864
Jenkins Ring

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the SHORTEST distance

Let Treco show you how short the distance from the ground breaking ceremony to "on stream" can be.

The REFINERY ENGINEERING Company's reputation for fast design, engineering and construction has been built upon the knowledge of how to speed up all operations through careful planning, without sacrificing quality. This is due, in a large degree, to actual refinery-operation experience of Treco's top men. This experience enables Treco to quickly analyze the problem from actual day-to-day contact and to come up with the right answer.

In addition to the constant use of commercial airlines, Treco uses its own stable of planes for the fast movement of staff engineers, who carefully make regular checks of all construction operations. The location of Treco's home office, in the center of the nation, also adds to the efficiency of operation.

On your next job, before the planning stage . . .

....talk with the TRECO man.....

To better serve our customers in the East, Treco has opened a district office at 10 Rockefeller Plaza, N.Y.
Henry T. Fielding
Manager
Telephone
Circle 7-2361

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The REFINERY ENGINEERING Company

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Square D Vertical Action Magnetic Starters Sizes 0, 1, 2, 3, 4 and 5

ONLY SQUARE D GIVES YOU ALL 5

1 *QUICK* INSTALLATION!

No groping or fumbling. Square D gives you lots of wiring space, plenty of knockouts, handy and clearly marked pressure wire connectors.

2 *TOP* PERFORMANCE!

No needless downtime from coil burnout, mechanical binding, contact freezing. Square D gives you an extra-capacity magnet with a tough and cool-operating encapsulated coil to handle additional poles and interlocks—a guided single moving part—big silver cadmium-oxide contacts with strong finger springs—arcing yokes on larger sizes.

3 *REAL* OVERLOAD PROTECTION!

No change in trip characteristics because of mismatched parts supplied separately for field assembly, no distortion of heater in installation. Square D gives you melting alloy unit construction—factory-assembled and individually tested for bull's-eye accuracy. Also bi-metal and magnetic designs for automatic reset or adjustable trip applications.

4 *EASY* INSPECTION and MAINTENANCE!

No starter is "maintenance-free." But Square D makes the job easy. Inspection is a breeze. You don't have to remove wiring for contact replacement or take the starter out of the enclosure to change coils.

5 *WIDE-RANGE* ADAPTABILITY!

No need for excessive inventories to avoid costly waiting for non-standard arrangements. Square D provides "off-the-shelf" kits for changing contacts and coils, adding pushbuttons, selector switches, and up to 4 double-throw auxiliary circuits.

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Oil tank lifted by two 35-ton P&H 555A-TC truck cranes and moved to new location at refinery tank farm.

THE P&H 555A-TC leads in the 35-ton truck crane class

At refinery, plant yard, pipeline or drill site—throughout the industry—the P&H 555A-TC is the unquestioned leader in the 35-ton truck crane class. Year after year it continues to create new records for profitable performance on all heavy-duty lifting, material handling and digging jobs.

Every feature of the 555A-TC adds to its versatility and ability to set new production records:

- **Independent planetary boom hoist—boom lowering is always done under power**
- **120-foot boom—30-foot jib**
- **Hydraulic controls for smooth, easy operation**
- **P&H "live roller circle" for fast lively swings**
- **All-welded, lattice type boom—stonger yet lighter**
- **P&H balanced weight distribution—greater stability**

Before you buy any power crane or shovel, get in touch with your P&H dealer. Write for complete information.

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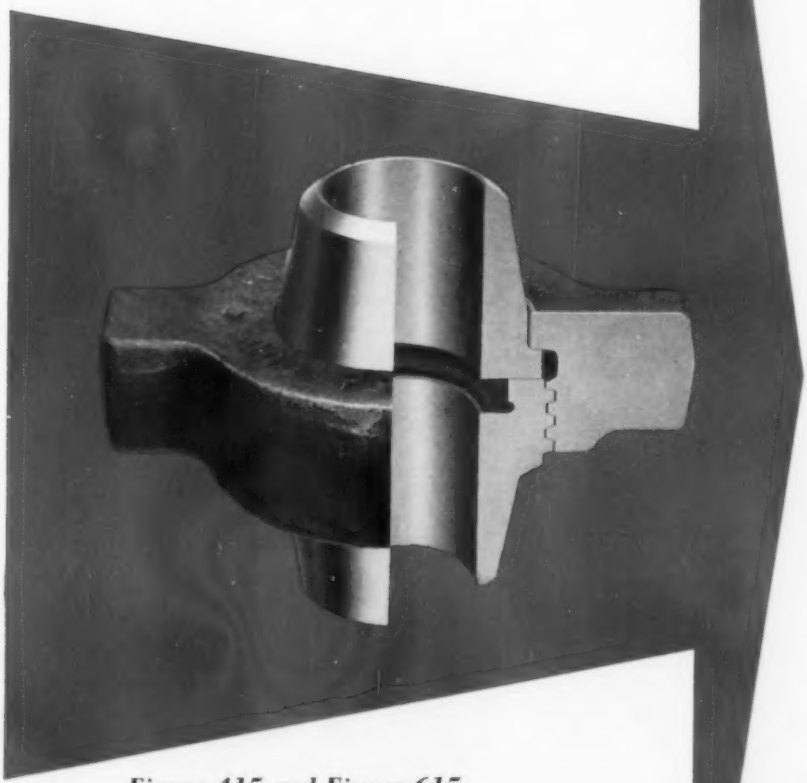
Construction & Mining Division
Milwaukee 46, Wisconsin

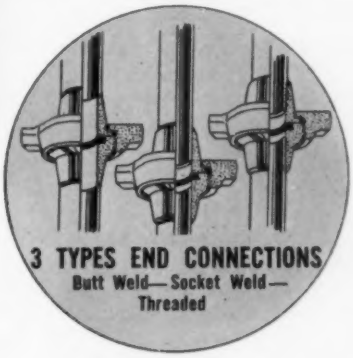
THE P&H LINE Excavators: ⅛ • ¾ • 1 • 1¼ • 1½ • 2½ • 3 • 3½ yards and 4 yards
Truck Cranes: 10 • 12½ • 15 • 20 • 25 • 30 • 35 • 45 and 60 tons

NEW WECO FLAT FACE UNION



EASY TO INSTALL
Slips in like a flange

POSITIVE SEALING
Resilient seal ring under compression between subs



3 TYPES END CONNECTIONS
Butt Weld—Socket Weld—Threaded

2 PRESSURE RATINGS
Fig. 415, 4000 lbs.
Fig. 615, 6000 lbs.

Figure 415 and Figure 615
Sizes: 2", 3", 4"
Pressures: 4000 psi test and 6000 psi test

Weco Flat Face Unions are stocked by supply stores everywhere. Order WECO Flat Face Unions when you need simplified, easy make-up of connections in limited space installations.

U-11-58

WECO®

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

Maintenance and Steam Traps

. . . there's a relationship that goes far beyond trap maintenance alone

Good traps and good trapping have a greater effect on your maintenance costs than does trap maintenance itself. By that we mean that the right traps, properly selected and installed, and with the benefits of a preventive maintenance program, will save far more maintenance dollars than they will cost.

Under the pressure of spiralling maintenance costs, this thought becomes mighty important. Let's take a look at what it involves:

Proper Selection of Steam Traps

1. Be sure it's the right type of trap.

2. Be sure it's sized right and is for the correct operating pressure.

3. Be sure it's first rate in design and construction.

Proper Installation of Steam Traps

1. Install them so they are accessible for inspection and maintenance.

2. Install a test valve.

3. Use a union or unions.

4. Use a shutoff valve or valves.

5. Use a strainer ahead of the trap if dirt conditions are bad.

6. Use a by-pass only where continuity of service is imperative.

7. Standardize inlet and outlet connections.

Preventive Maintenance Program

1. Test trap regularly for proper operation. (Trap size, operating pressure and importance determine frequency.)

2. Inspect internal mechanism at least once a year.

You Get Indirect Benefits As Well

The direct benefits of the plan outlined are pretty obvious — good traps, properly selected, require less maintenance . . . testing and inspection prevents troubles that lead to maintenance.

However, this plan provides indirect benefits which reduce maintenance in other parts of the plant as well:

Good traps save steam and reduce the load (and consequently maintenance) on fuel handling and burning equipment and on ash handling equipment.

Good traps protect the system by eliminating water hammer and preventing the damage it can do.

Good traps discharge carbon dioxide before it can go into solution to form corrosive carbonic acid — less corrosion, less maintenance.

Good traps increase production to reduce the length of time equipment must operate or reduce the amount of equipment needed . . . either way maintenance is reduced.

How to Go About It (The Sales Pitch)

We admit we're prejudiced, but we don't think there is any better way to select steam traps than with the help of the 44 page Armstrong Steam Trap Book. Here in a single source is specific data on the selection and sizing of traps, how to install them for best results, and how to maintain them most economically.

The Steam Trap Book will also give you full information on the design and construction of Armstrong Inverted Bucket Steam Traps that offer these important maintenance-reducing advantages:

1. Armstrong Traps are dependable.

2. Armstrong Traps require no adjustments — go from full load to zero load automatically.

3. Armstrong Traps are self-scrubbing—ordinary dirt conditions can't hurt them.

4. Armstrong Traps have long-life parts — valve and seat are heat treated chrome steel — lever assembly and bucket are stainless steel.

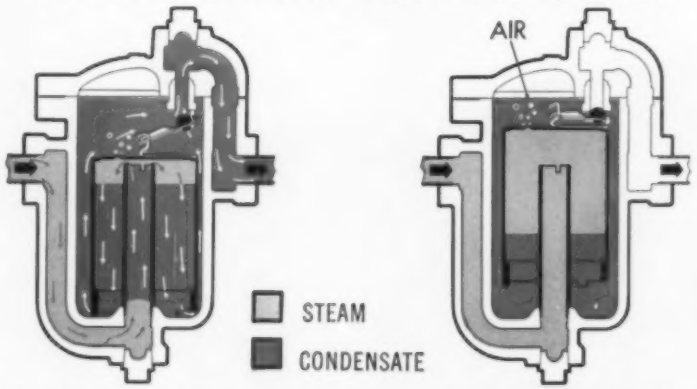
5. Armstrong Traps have water sealed valves to minimize wire drawing and erosion.

Ask for your copy of the Steam Trap Book—there is no obligation. Then test Armstrong Trapping. If you are not completely satisfied with the results, you can return the traps for a full refund of the purchase price. You can't lose much that way. Call your local Armstrong Representative or Distributor, or write

Armstrong Machine Works
8688 Maple Street
Three Rivers, Michigan

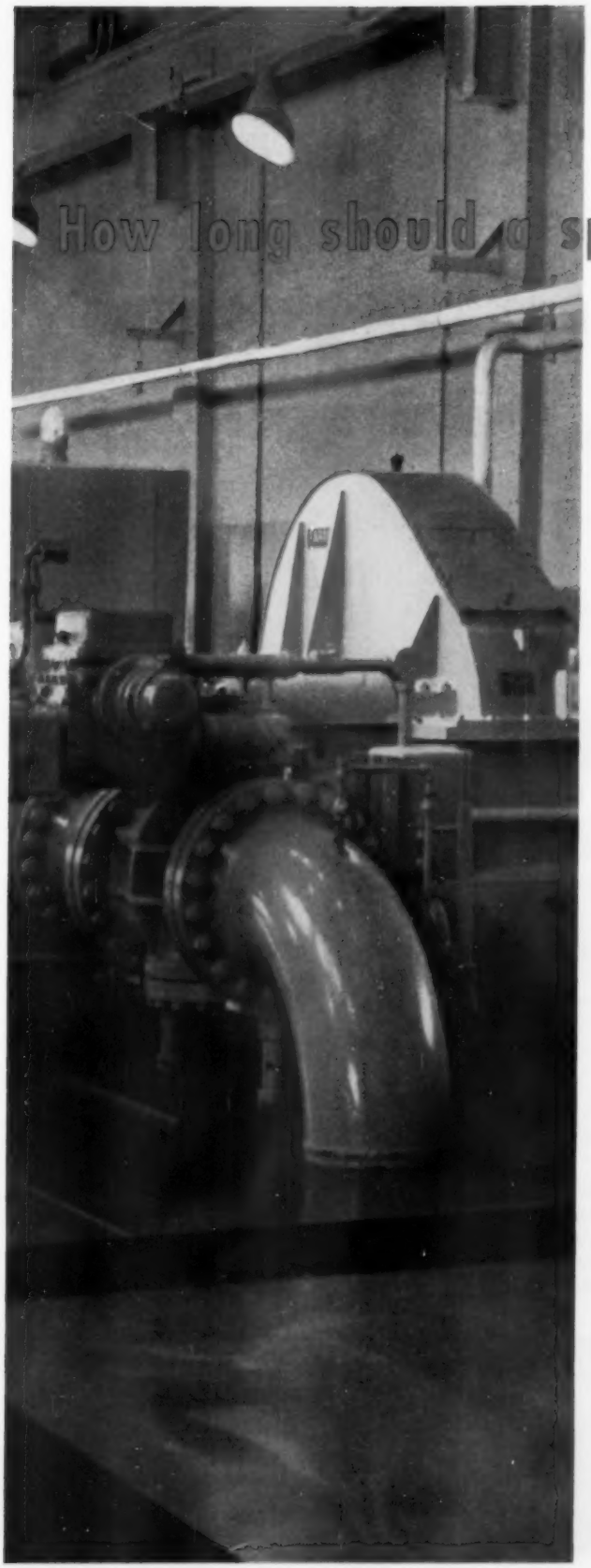
ARMSTRONG STEAM TRAPS

HERE'S THE STEAM TRAP DESIGN THAT CAN REDUCE YOUR MAINTENANCE PROBLEMS



Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.

Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.



How long should a speed increaser last?

True, there is no firm and fast rule for predicting how long a speed increaser will last in pipeline service. There are, however, some dependable clues. Most practical of all is performance under actual operating conditions.

How do Farrel speed increasers measure up when this service yardstick is applied? The answer is on record: Since 1932, when the first of these units was placed in operation, not one has ever been taken off the job. *This indicates that the life expectancy — or average service life — of a Farrel speed increaser is not less than 25 years!*

Design features tell the story. For example, teeth are continuous across the full face width of each gear — paying off in bonus strength and load-carrying capacity. Oversize shafts guard against torsional deflections under peak torque variations. Shafts are mounted in husky, precision-finished bearings. The rigid housing preserves original alignment of moving parts.

When you're in the market for speed increasers, remember the extra stamina that's built into every Farrel unit. It's your assurance of long-range speed-increasing economy.

In the meantime, send for a copy of bulletin No. 451.

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Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

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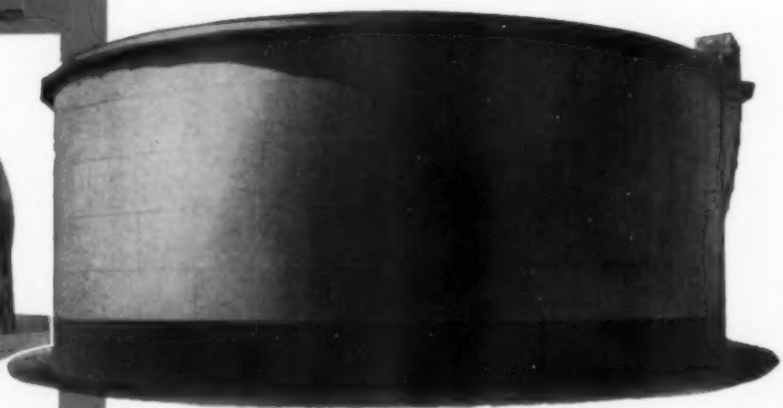
STORAGE TANKS and PLATE FABRICATION

DIALIFT* tank with vapor-cover diaphragm

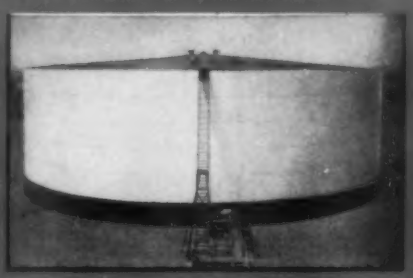
Hammond Sphere



Hammond **TUBESEAL*** and **SPRINGTITE*** Floating Roof Tanks

Process Vessels—Steel • Stainless • Alloys • Cladmetals

Water Storage Tanks



Cone Roof Tanks

The universal acceptance of Hammond-built equipment is the result of more than half a century of experience in the design, fabrication and erection of storage tanks, process vessels and steel plate construction for the petroleum, chemical and allied industries, and for water supply.

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HAMONDTANK

Turn your pressure tube problems into savings

Timken Company metallurgists can select the one steel analysis that gives you maximum tube life-per-dollar

A lot of steels can solve the pressure, temperature and corrosion problem that your particular operation creates. But it takes skill to find the one and only steel analysis that gives you longest tube life for your dollar.

Timken Company metallurgists have the special skill to save you money while solving your pressure tube problem. They're recognized experts backed up by more than 25 years of research and experience in high temperature steels. They've solved hundreds of industry's toughest pressure problems the same way they'll solve yours—economically.

And they've got the steels at their fingertips. You can get Timken® seamless pressure tubes in sizes up to 11″ O.D. x 3¼″ wall—available in all stainless and alloy grades.

One analysis of Timken fine alloy steel will meet your operating conditions best. And you can be sure it's an accurate analysis because we make only electric furnace fine alloy steel and use rigid quality controls to give uniformity from heat to heat, order to order, tube to tube.

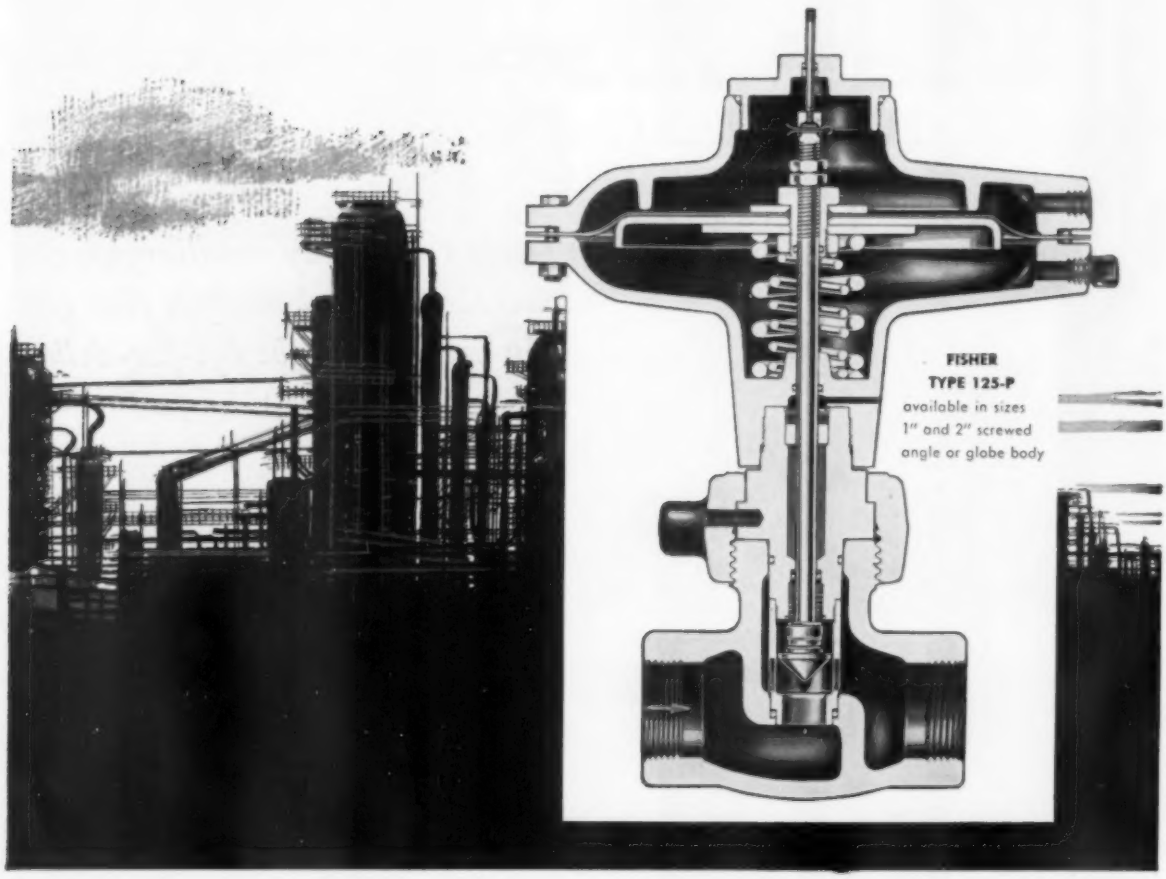
Get in touch with Timken Company metallurgists next time you have a pressure problem. They'll solve it the only way they know—economically. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

Compact and versatile...



...a rugged field valve made especially for the oil industry

- Has rugged, heavy duty cast steel body that can take up to 3000 psi.
- You can interchange topworks with any other body in the series.
- You can get reversible topwork action with no additional parts.
- The single hardened steel inner valve fits all orifices.
- Diaphragm casings suitable for 50 psi operating pressure.

If you want to know more about the Fisher Series 125-P High Pressure Diaphragm Control Valve, send for Bulletin O-125P.

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD . . . CHANCES ARE IT'S CONTROLLED BY

FISHER GOVERNOR COMPANY

Marshalltown, Iowa / Woodstock, Ontario / London, England

FISHER® Controls

SINCE 1880

This wellhead test stand area in our Corpus Christi store is one of six similar field facilities in the United States and Canada.

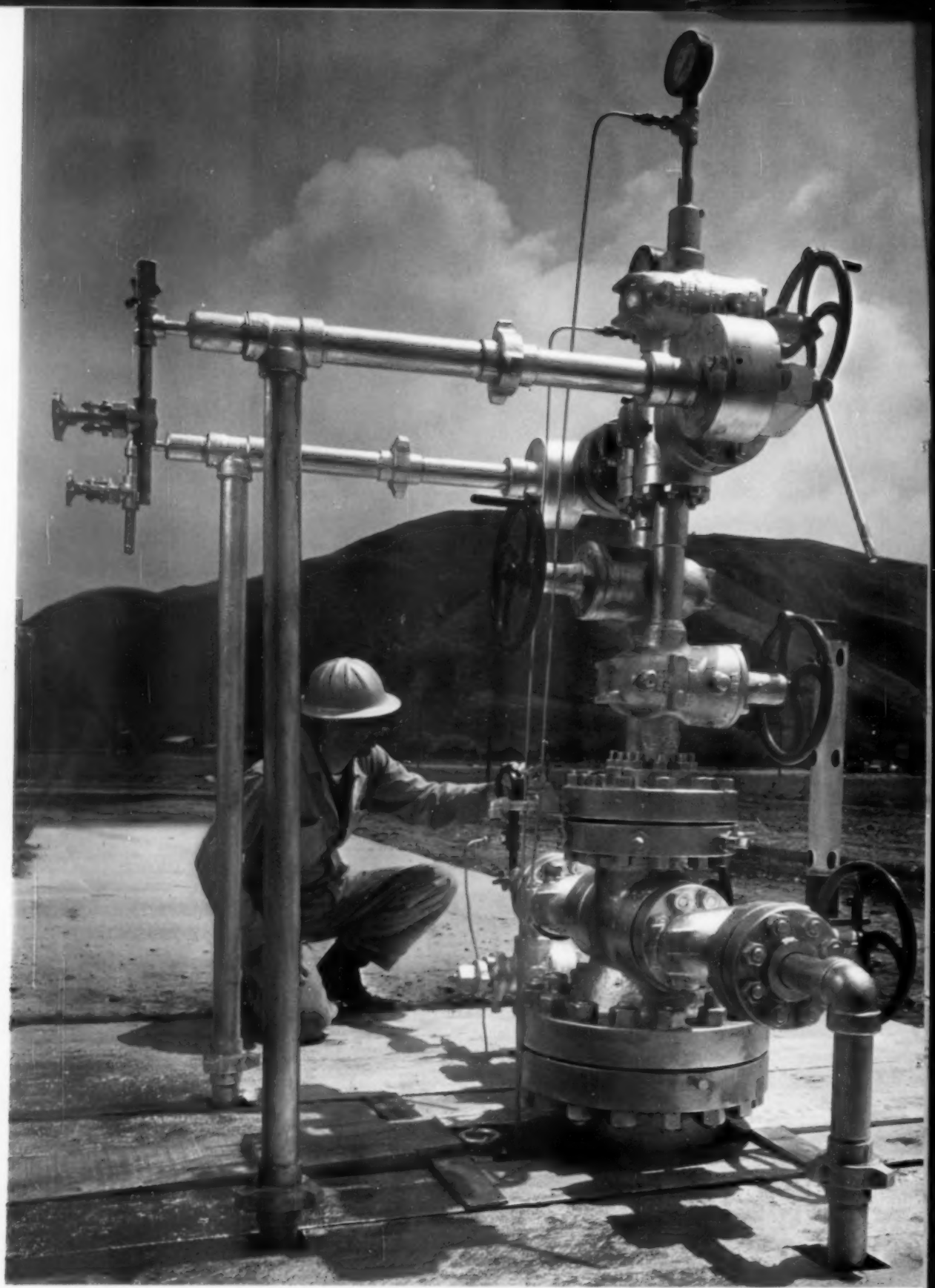
Wellhead test stand is another National field service

When you need repair and reconditioning work on wellhead equipment you usually need it fast. Above all, you must be sure of a unit's safety. For these reasons, National Supply maintains six conveniently-located wellhead test stands in the United States and Canada.

These special field facilities for the hydrostatic testing of wellhead assemblies save more than time. Because they are in, or close to, major production areas, operators save on shipping and handling costs. Add to these benefits the complete line of wellhead parts and specialty items immediately available in National Supply Store stocks . . . and you have the reasons why this wellhead service is so popular.

The next time you need a "like new" repair or reconditioning job on a wellhead assembly, contact the National representative or store personnel in your area. You'll get fast service and thoroughly tested, quality equipment. In fact, these are the same two results you get on whatever you buy from National Supply.

National dual-completion equipment on the next page



This National Supply dual completion wellhead assembly is located near Ventura, California. It utilizes the time-proven Laurent* seal, provides completion cycle "Preventer Control" and sealed-in-steel construction for the life of the well.

You get safe, profitable completions with National dual string wellhead equipment!

All the basic benefits of field-proved National Wellhead Equipment are contained in National's dual string assemblies. Simplicity of design makes them easy to assemble and maintain. Parts are self-locating and self-activating. Interchangeable units provide a flexibility that enables you to "do more with fewer pieces." And, every assembly is intensively pre-tested to insure complete safety.

National offers five types of dual string wellhead equipment designed for safe, profitable completions in a full range of working pressures:

Type DST—Used in any National Type E, W, and B, 6" nominal size tubing heads over 5½" or larger casing. Generally installed on dual zone pumping installations requiring a macaroni or vent string.

Type DS-1—These bonnets provide maximum flexibility and greatest economy for shallow or medium depth wells. Ordinarily used on medium pressure wells, they are easily converted to pumping installations.

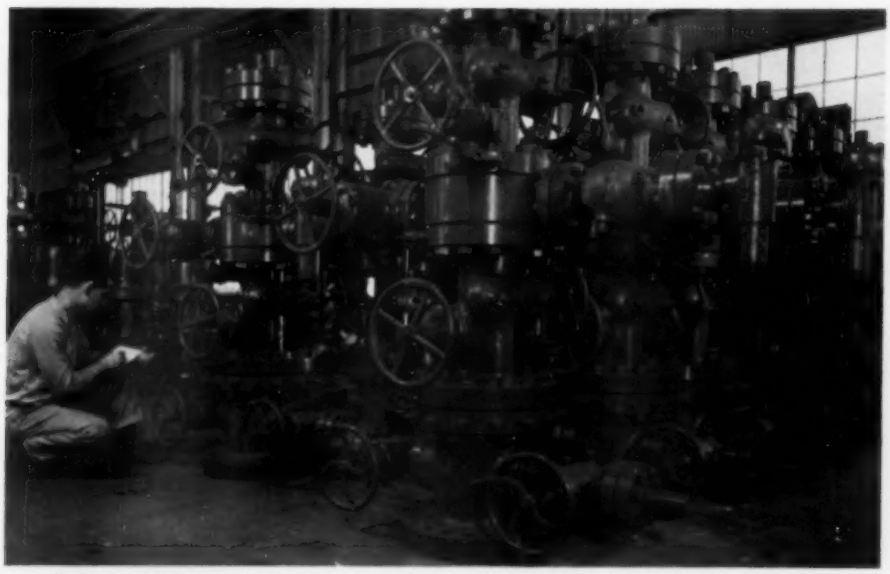
Type DF-1—Similar to DS-1, but incorporating the efficient Laurent* seal. Used for medium or deep wells where independent flanged valves are desirable, and controlled displacement is required.

Type DP-1—Permits "controlled completion." It is supported in a hanger body for suspension of the tubing strings, and allows either string to be pulled, subsequently, without disturbing the other.

Type DP-3—Has an advanced automatic hanger design which eliminates the need for over-size preventers in "controlled completions."

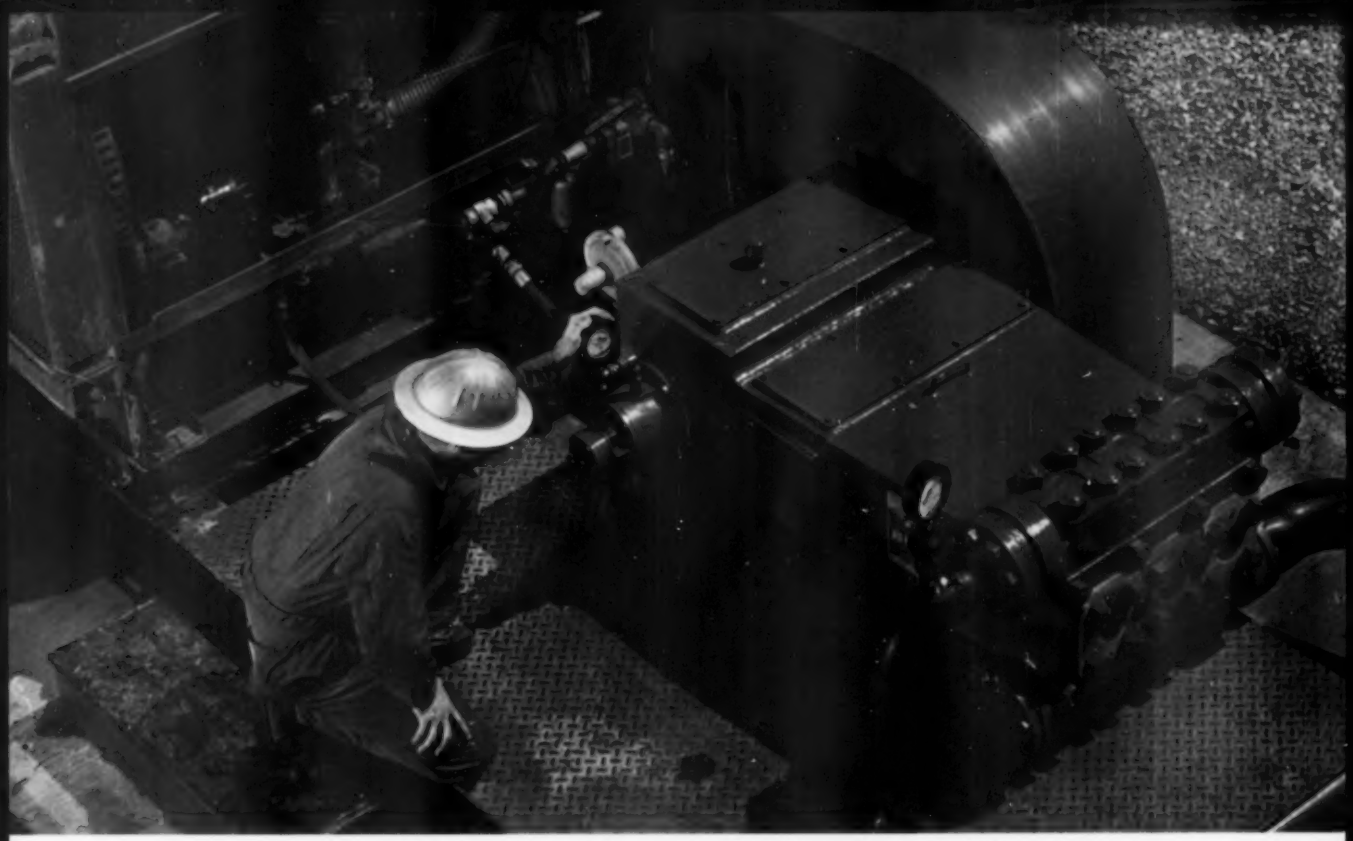
Get the complete story on the benefits of National dual string wellhead equipment from the National representative in your area. It could save you much time and money.

*Patent No. 2,687,229



Serial numbers are checked on these dual completion assemblies ready for shipment from National Supply's Houston Plant. National assemblies for every wellhead condition —as well as advisory service on applications—are available through National Supply Stores.

More National equipment for profitable production on the next page



National Triplex Pumps are reliable on a host of oilfield pumping jobs including water-flooding, salt water disposals, and as power-oil sources for subsurface hydraulic pumps.

...and you get low-cost pumping with National Triplex Pumps!

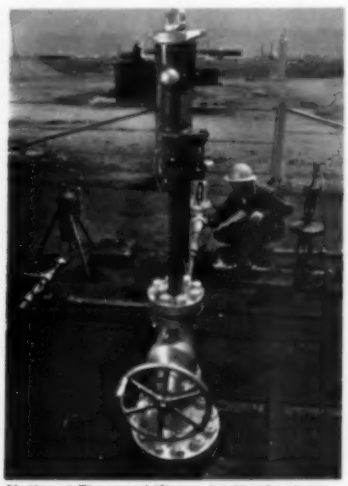
A minimum of pumping downtime means low-cost pumping, and that's what you get with National Triplex units. They have heavy-duty housings and frames, long-life bearings, stainless steel valves, and National's time-proven lubrication systems.

Plungers, fluid ends and cartridge-type stuffing boxes are readily interchangeable to meet varying pressure and volume needs, and are available for either corrosive or non-corrosive service. In every respect, these triplex pumps show the quality construction for which all National Supply equipment is famous.

Ask the National representative in your area for more information on National Triplex Pumps—and any of the other dependable production equipment shown on this page.

Get reliable service from precision-made National Sucker Rods. They have top resistance to fatigue, shock, corrosion and impulse loads. National Sucker Rods are available in a range of grades to meet every well condition.

National Pumping Units are manufactured in 22 standard combinations, plus various long stroke and portable variations. In the range of API rated beam loads from 3,200 to 32,400 lbs., there's a unit to economically meet your needs.



National Plunger Lift can be the best production method for certain types of wells. It uses formation gas or injected gas for operation, has low initial and service costs. Equipment is also available for gas well operation to remove liquids and maintain a uniform and increased flow rate of gas.

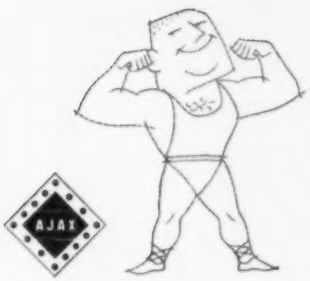
THE **NATIONAL SUPPLY** COMPANY

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Pa.
DIVISION OFFICES: Dallas; Denver; Houston; Toledo; Tulsa; Torrance
CANADA: The National Supply Company, Ltd., 200 F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta
EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E. C. 1

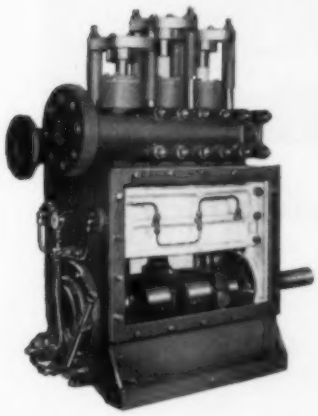
NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

3 Great Performers—

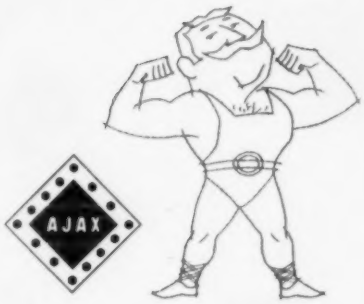
IN THE FLUID INJECTION FIELD!



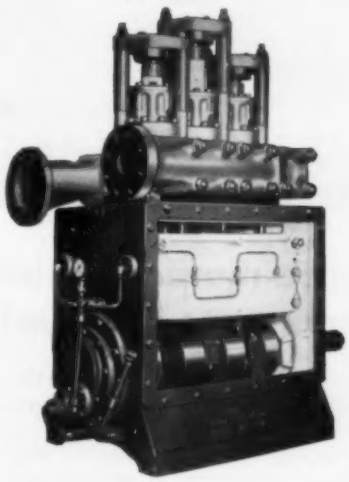
TRIPLEX 4000 PUMP



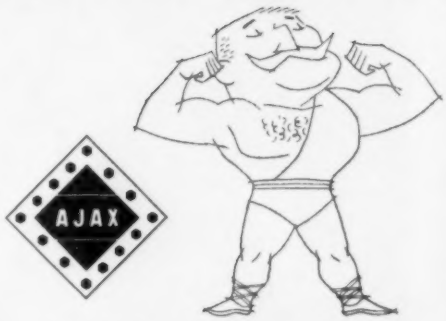
5.2 to 123.5 gpm
Pressures 4980 to 835 psi



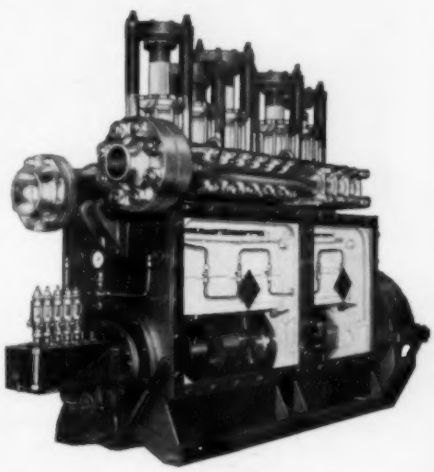
TRIPLEX 5000 PUMP



9.6 to 258.2 gpm
Pressures 4940 to 665 psi



QUINTUPLEX PUMP



16.0 to 430 gpm
Pressures 4940 to 665 psi

AJAX

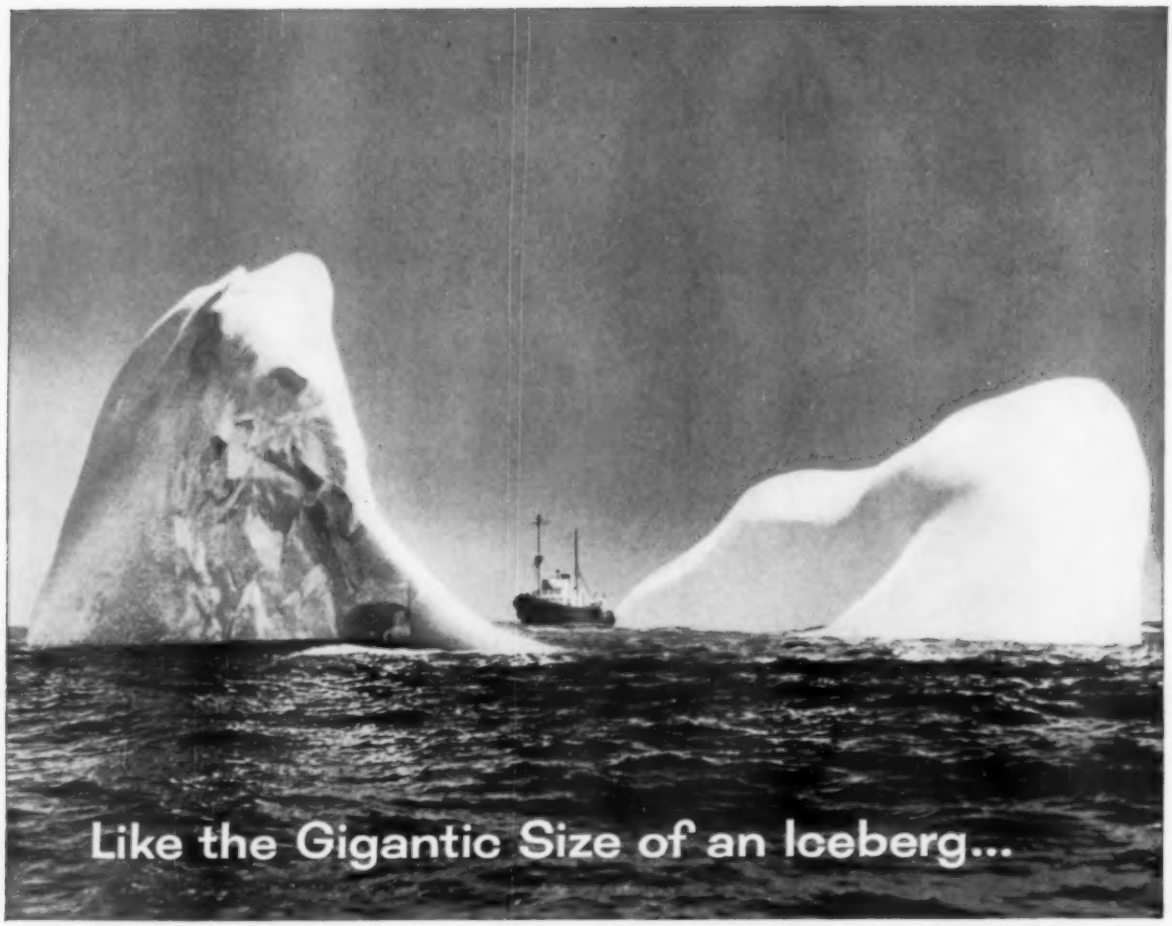
Ajax Vertical Pumps offer a broad range of capacities for fluid injection and down-well pumping demands, with unfailing dependability for pressure maintenance around the clock. In the years since their introduction, Ajax Triplex Pumps have led the field in stamina and low maintenance on the toughest pumping jobs. The new Ajax Quintuplex brings high capacity with the same Ajax top quality construction—and is the *first* pump to feature a crankshaft mounted on THREE double-row, tapered anti-friction roller bearings. Typically AJAX . . . ask your Supply Man for descriptive bulletins!

AJAX IRON WORKS

Builders of GAS AND OIL ENGINES, PRESSURE PUMPS, STEAM ENGINES

CORRY, PENNSYLVANIA

Oil Field Distributors: THE NATIONAL SUPPLY CO., PITTSBURGH, PA. • R. B. MOORE SUPPLY CO., BOLIVAR, N. Y. • BETHLEHEM SUPPLY CO., TULSA, OKLAHOMA



there's more to Cities Service than meets the eye!

Mammoth as it may appear to the eye, an iceberg is normally eight times the size of its visible portion. Seven-eighths lies submerged and unseen beneath the surface.

Few spectacles of nature are so awesome as the iceberg. Hundreds of yards in length, it rises 100 feet or more above the sea, with crests or minarets spiring higher to 200 and even 300 feet.

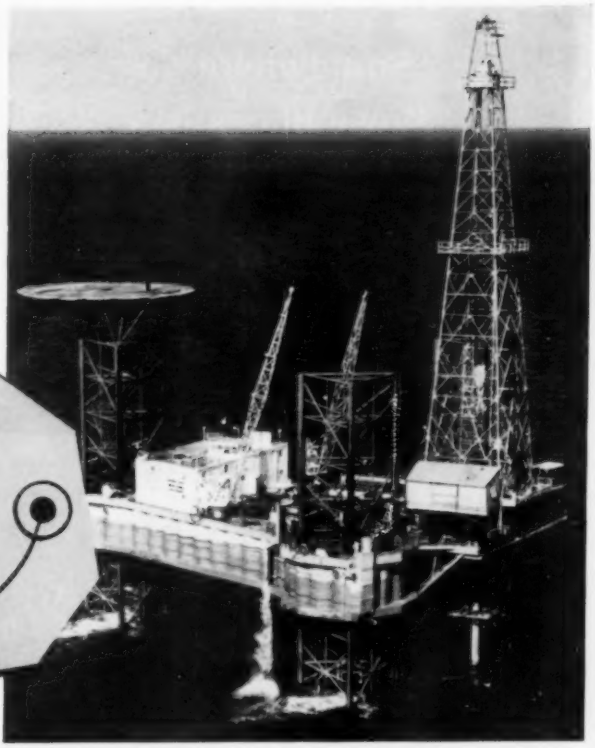
Yet, only about one-eighth of an iceberg's mass rides in view. The great bulk lies hidden in the ocean depths.

Similarly unseen by most of the public they serve are the far-flung facilities of petroleum enterprise—towering derricks in the oil fields—mighty refineries—thousands of miles of pipeline—fleets of ocean-going tankers—wonderful modern laboratories.

Costly? Yes—the capital invested in the business of a major oil company such as Cities Service exceeds a billion dollars. Without these facilities and the skilled men and women who operate them, the American petroleum job could not be done . . . and petroleum, next to food, is America's most vital product today.

CITIES SERVICE

LeTourneau
"Portable" Offshore Drilling Platform



Equipped with ALLEN-BRADLEY Motor Control

This new LeTourneau portable offshore drilling platform can be moved from one work location to another and can be set up in a matter of hours. LeTourneau selected reliable Allen-Bradley motor control for this equipment.

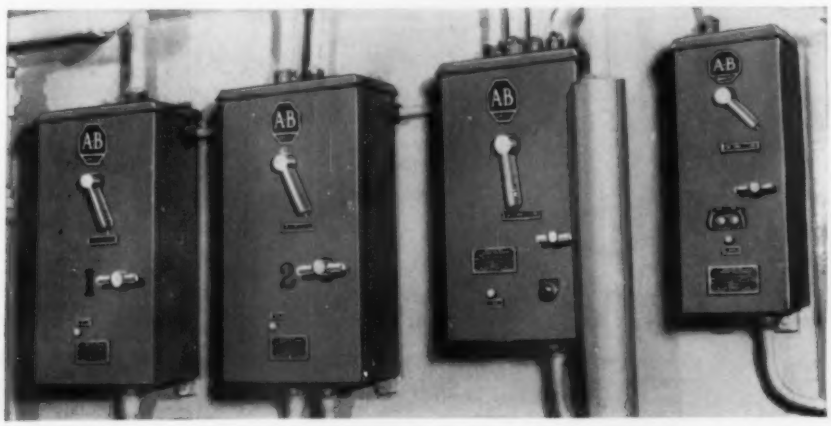
Wherever there's a tough motor control job to be done —as in this LeTourneau offshore oil drilling rig—that's where you'll find Allen-Bradley *quality* motor control.

The unequalled dependability of Allen-Bradley control results from its simple solenoid design . . . around which *all* Allen-Bradley starters, contactors, and relays are built. They have only *one* moving part . . . your assurance of *millions* of trouble free operations. There are no bearings, pivots, or pins to corrode and stick . . . no flexible jumpers to wear and break.

In addition, the double break, silver alloy contacts . . . used throughout the entire Allen-Bradley line . . . never need cleaning, filing, or dressing. You can limit even routine inspection to once or twice a year, for the contacts are *always* in perfect operating condition. And the permanently accurate overload relays provide reliable motor overload protection, irrespective of time or atmospheric conditions.

Be sure to specify Allen-Bradley for *all* your motor control requirements—you *cannot* go wrong. Send today for your copy of the latest A-B Handy Catalog . . . a real encyclopedia of motor control information.

Allen-Bradley Co., 1304 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.



A-B QUALITY

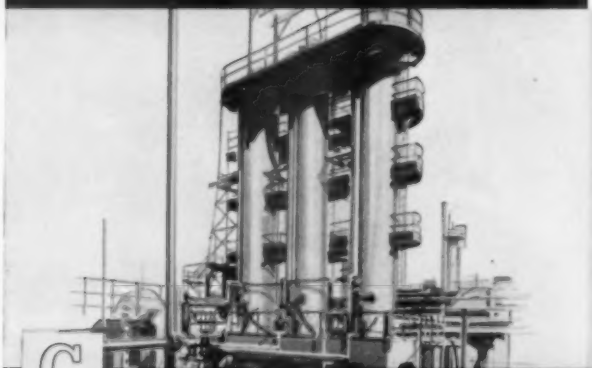
Allen-Bradley marine type combination starters installed on the LeTourneau drilling platform. Allen-Bradley has a complete line of enclosures—general purpose, watertight, weather-resistant, explosion-proof, and corrosion-proof—to satisfy all operating conditions.

Somewhere on these pages is a

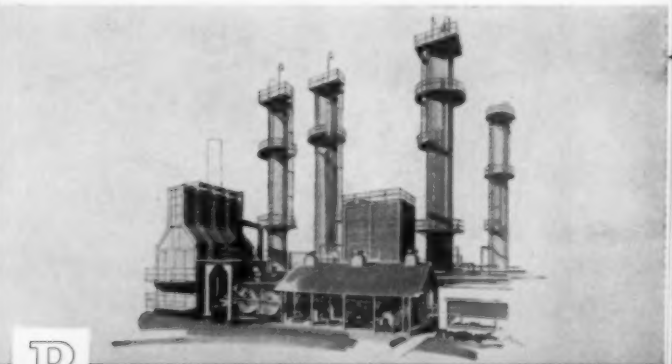
UOP

answer to most every petroleum processing problem.

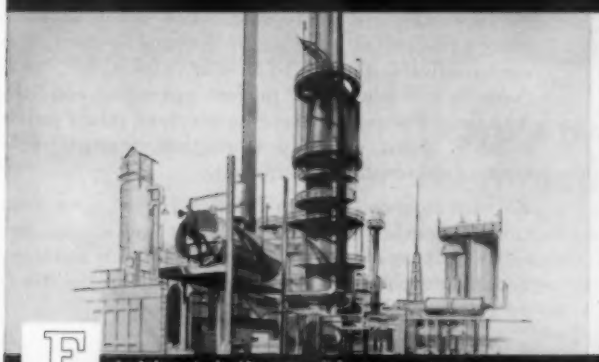
Working out the solution to a processing problem can be a pretty tough assignment for any refiner. But this is a UOP specialty and it's highly probable that UOP can come up with the right answer. Perhaps, we don't have all the answers right on tap but our more than 40 years of research and engineering development in oil refining technology is pretty good assurance that we can work them out. Quite possibly you will find



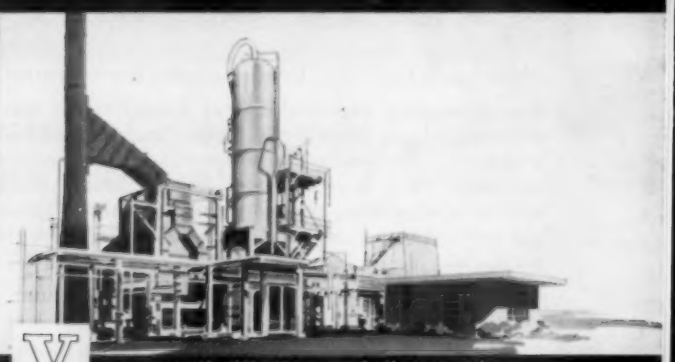
Catalytic polymerization A process for converting propylene and butylenes to high grade gasolines



Penex® The first practical process for upgrading pentane and hexane fractions

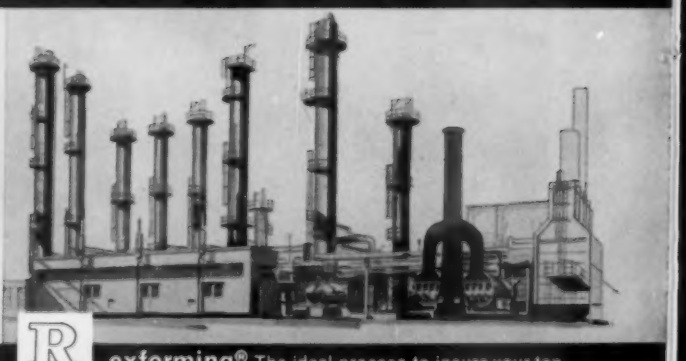


Fluid catalytic cracking Improved heavy oil conversion process for higher yields and octane numbers



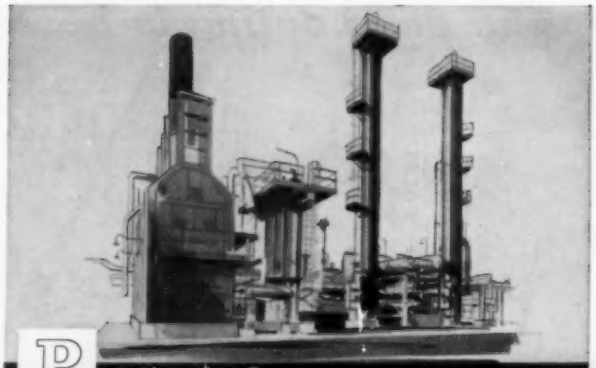
Vacuum distillation and visbreaking Efficient, economical processes for feed preparation

Low pressure coking A process that adds market flexibility

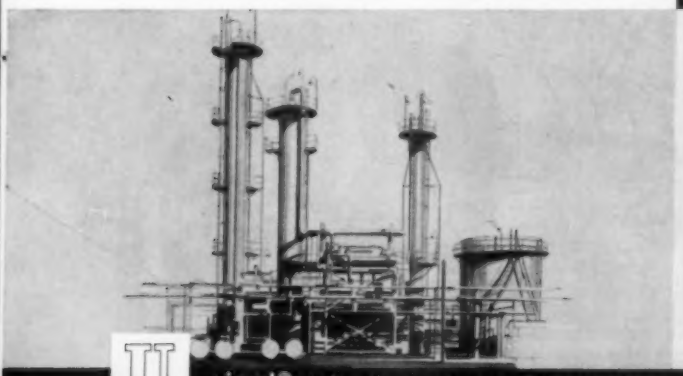


Rexforming® The ideal process to insure your top octane position

the solution among the processes shown here. For these represent only some of the refining and petrochemical processes UOP makes available to all refiners, anywhere. If you would like to know more about all the refining and petrochemical processes available from UOP we'll be glad to send you our handsome new 36 page brochure describing these more fully. Just drop us a line on your company letterhead.



P latforming® The most popular process for upgrading gasolines



U nisol® A finishing process without octane degradation

U nifining* A modern process for completely purifying petroleum distillates

HF Alkylation A catalytic process for producing alkylate

T hermal cracking An improved design of a basic refining process

U dex® A process for separating gasoline into high and low octane fractions

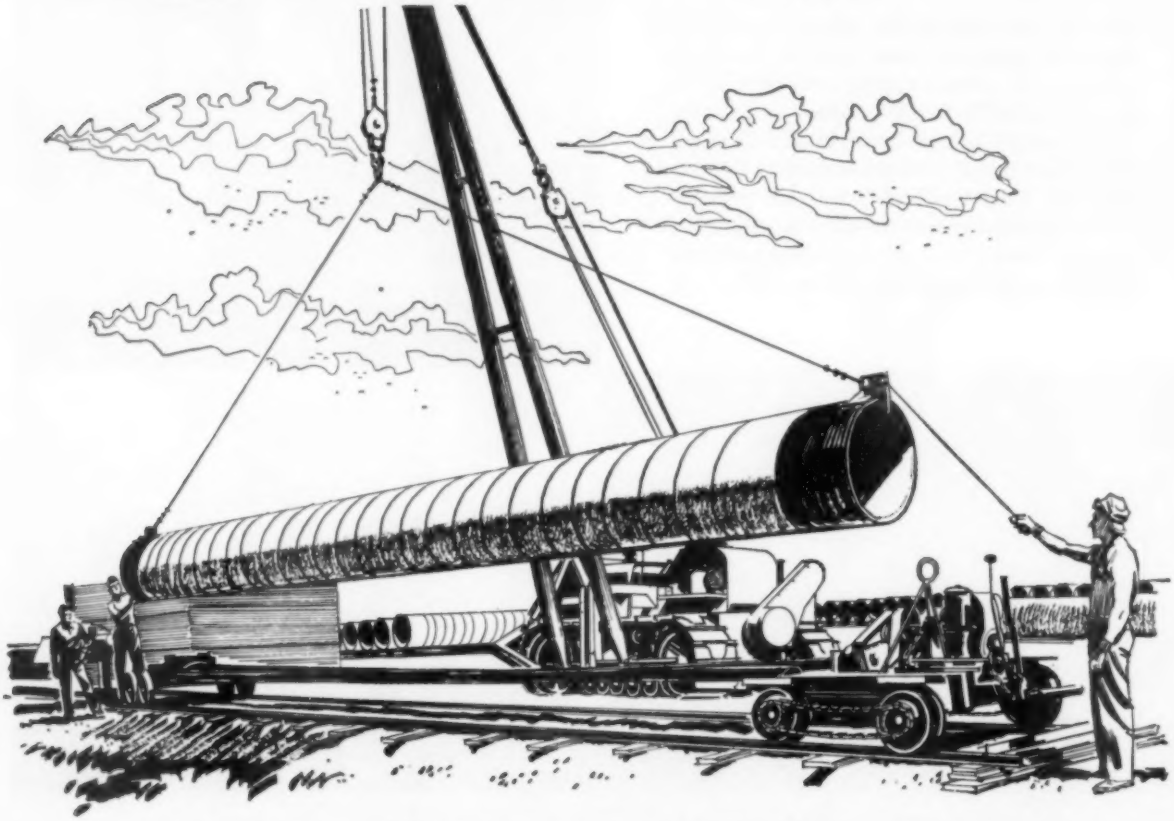
UOP® UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road
Des Plaines, Illinois, U.S.A.

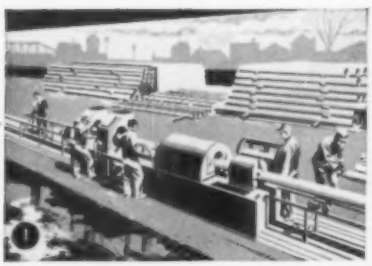
MORE THAN FORTY YEARS OF LEADERSHIP IN PETROLEUM REFINING TECHNOLOGY

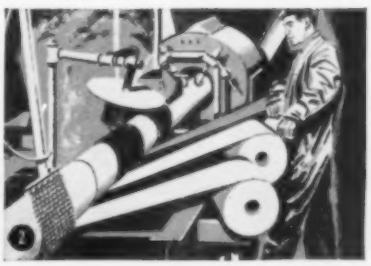
*Trademark

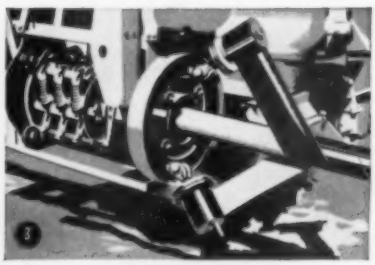
no one coating is best for every job



that's why Dearborn supplies all three







Varying circumstances, job conditions, and even budget limitations prohibit specifying one type of coating for every pipeline. That's why Dearborn offers you all three: asphalt coatings; wax-type coatings; polyethylene plastic tape. These superior coatings, together with the correct primers and wrappers, may be applied at the mill, railhead, by hand or Traveliner. Your local Dearborn representative can help you select the right coating combination for your specific job at lowest possible cost.

CALL YOUR DEARBORN MAN OR WRITE FOR INFORMATION

1. Asphalt Coatings. Write for your copy of Bulletin 3083-A.
2. Wax-Type Coatings. Write for your copy of Bulletin 3050.
3. F.O.S. SAFE-T-CLAD Polyethylene Plastic Tape. Write for Bulletin 3002.

Dearborn® CHEMICAL COMPANY

MERCHANDISE MART PLAZA, CHICAGO 54, ILLINOIS

WORLD'S MOST COMPLETE LINE OF PROTECTIVE MATERIALS FOR THE CONTROL OF CORROSION

AAF Type W Cycoils assure clean air to gas compressors at this field processing plant of the Odessa Gasoline Company in Ector County, Texas.

AAF Cycoils protect compressor equipment day-in-day-out—require little maintenance

Why are AAF Cycoil oil bath air cleaners used for so many unmanned pumping stations and automatic plants? The reason is simple: Cycoils are known and *trusted* for dependability and efficiency. What's more, they require only infrequent maintenance because filter pads are self cleaning. Periodic replacement of oil is all that's required.

Cycoils' method of intermixing oil and dust-ladened air traps 90% of the fine dust particles before they ever reach the final filter pads. That's why Cycoil-cleaned air is virtually 100% dust-free!

Whether it's a pulsating action or smooth flow application, involving packaged or stationary compressors, there's a Cycoil of a type and capacity to meet your needs. Write today for bulletins describing the complete line of Cycoil oil bath air cleaners.

Type CMS Multi-Duty Filters

Type G Pipeline Air Filters

AAF

American Air Filter
COMPANY, INC.

444 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

BETTER AIR IS OUR BUSINESS

Type OCH Intake Air Filters

Cycoil Oil Bath Air Filters

PETRECO

ELECTROFINER CUTS NITROGEN BASE CONTENT OF COKER NAPHTHA BY 99%

The Ohio Oil Company of Robinson, Illinois, uses a Petreco Electrofiner to treat coker naphtha prior to blending with straight-run charge to the reformer. Approximately 1000 bbls/day make up the coker distillate stream—about 15% of the reformer charge.

In the Petreco Electrofiner this stream is intimately contacted with alkylation acid, separated and passed into the neutralization phase—all automatically controlled by instrumentation. The rapid separation makes possible the removal of the nitrogen base material without materially affecting the olefin content of the coker naphtha. Note the additional benefits derived from Petreco Electrofining, as indicated in the following table:

	BEFORE PETRECO Electrofining	AFTER PETRECO Electrofining
Gravity °API	49.3	49.3
Nitrogen, ppm	116.0	3.36
Olefins, %	45.7	43.3
Aromatics, %	13.3	12.4
Acid oils, ppm	298.0	135.0
Mercaptans, wt. %	.034	.015
Lead, ppb	80	under 10

■ *Prior to the Petreco Electrofining installation, the nitrogen base material so curtailed the octane yield on the reformer that the coker naphtha could not be used as a part of the reformer charge. With the Electrofiner on the job, this and other problems resulting from preheat fouling and nitrogen poisoning of reforming catalysts were effectively diminished.*

WHERE IS PETRECO ELECTROFINING EQUIPMENT BEING USED TODAY?

Applicable to all distillate stocks, Petreco Electrofining is currently being used to treat such stocks as straight-run gasolines and naphthas, jet fuels, burning oils, diesel fuels, vacuum distillates, lube oils, gas oils, heavy cat naphthas, alkylates and many others.

HOW IS IT BEING USED?

Petreco Electrofining is successfully removing mercaptans, naphthenic acids, sulfur, tarry acids, hydrogen sulfide, arsenic, lead, color bodies and gum formers.

Petreco Electrofining can be installed *for about 1/10th the cost of hydrotreating.*

If you have a treating problem, it will pay you to investigate Petreco Electrofining first!

PETRECO

DT 59-2

A DIVISION OF PETROLITE CORPORATION

3202 SOUTH WAYSIDE DRIVE, HOUSTON 1, TEXAS • 1390 E. BURNETT STREET, LONG BEACH 6, CALIF.

Specialized Petroleum Treating Processes and Equipment

DESALTING • DEHYDRATING • DISTILLATE TREATING • SWEETENING • LUBE OIL TREATING • SEDIMENT REMOVAL

LARGER SIZE RANGE

MIDWEST ELBOWS

IMPROVED DELIVERY

HEAVY WALL CARBON STEEL AND ALLOY

12" Long Radius
2¼" Wall Thickness
1¼% Chrome

20" x 10" Reducing
2" Wall Thickness
2¼% Cr—1% Mo.

STRAIGHT LONG RADIUS 90° ELLS

Nominal Pipe Size	Maximum Wall Thickness
36	1.250
30	2.000
26	2.000
24	1.500
20	1.375
18	2.250
16	2.125
14	1.750
12	2.000
10	2.000
8	1.750
6	1.000
5	.625
4	.750
3	.625
2½	.375
2	.500

These straight elbows can be furnished with LONG TANGENTS at no extra cost. All thicknesses less than these shown above are, of course, available.

The exclusive Midwest method of making all welding elbows from plate instead of tubing gives us a FLEXIBILITY OF MANUFACTURE that is much greater than by any other process. These heavy wall Midwest straight and reducing elbows are available in any material that can be secured as plate. The maximum wall thicknesses for which we now have equipment are indicated by the tables at left and right. And, because it is easier to get plate than tubing, better delivery is another advantage. Still another is the close tolerances inherent in our process.

Quality control goes beyond all code requirements. The longitudinal weld of every heavy wall elbow is completely X-rayed as standard procedure in our method of manufacture.

You will find it to your advantage to send us your inquiries.

REDUCING LONG RADIUS 90° ELLS

Nominal Pipe Size	Maximum Wall Thickness
30	2.000
26	*
24	2.000
20	2.000
18	2.000
16	1.500
14	1.750
12	2.250
10	2.000
8	1.750
6	1.000
5	.625
4	.750
3	.625
2½	.375
2	.500

Reductions to all nominal pipe sizes down to ½ large diameter. All thicknesses less than those shown above are, of course, available.
*Refer to factory.

MIDWEST PIPING COMPANY, INC.

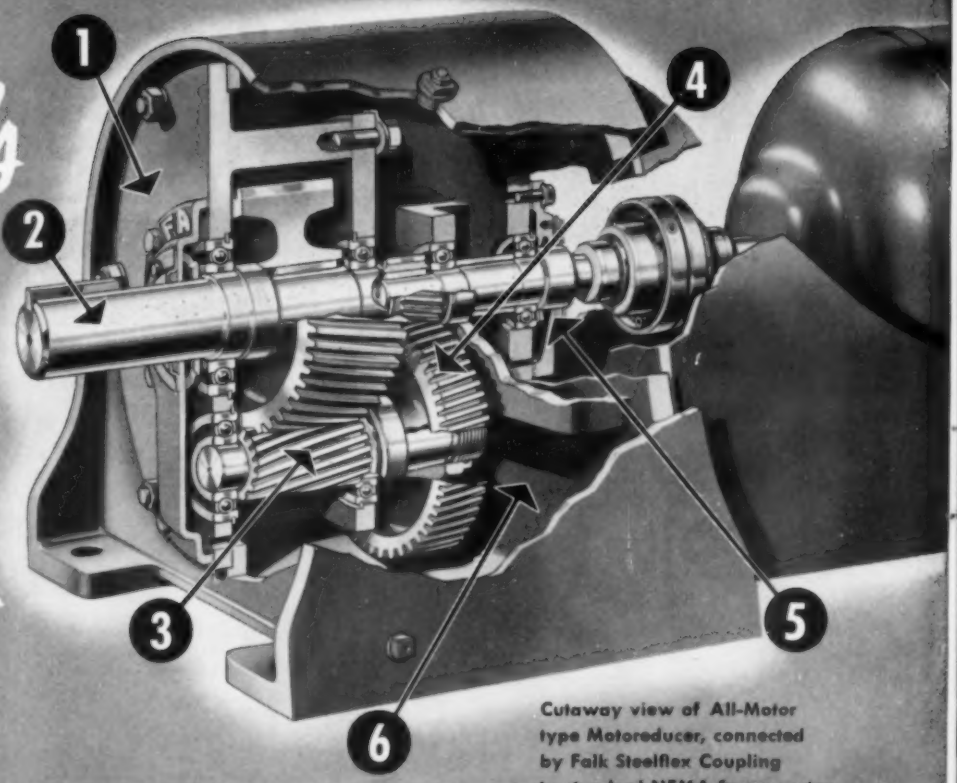
Main Office: St. Louis 3, Missouri (P. O. Box 433) • Plants: St. Louis, Clifton, N. J. and Los Angeles

Sales Offices

ASHEVILLE (BOX 446, SKYLAND, N.C.)
ATLANTA 9—72 ELEVENTH ST., N.E.
BOSTON 27—426 FIRST ST.
CHICAGO 3—79 WEST MONROE ST.
CLEVELAND 14—616 ST. CLAIR AVE.
HOUSTON 2—1213 CAPITOL AVE.
LOS ANGELES 33—520 ANDERSON ST.
MIAMI 34—2103 LE JEUNE RD.
NEW YORK 7—50 CHURCH ST.
PITTSBURGH 19, PA.—437 GRANT ST.
ST. LOUIS 4—1450 E. SECOND ST.
SAN FRANCISCO 11—420 MARKET ST.

STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

Here's the inside story—



Cutaway view of All-Motor type Motoreducer, connected by Falk Steelflex Coupling to standard NEMA frame motor

WHY Falk Motoreducers give better service—have longer life

Here is the "inside story" behind the all-steel All-Motor type FALK Motoreducer's universal reputation as a gear drive unmatched in quality, efficiency, dependability, ease of maintenance and long life. These "In-built" factors are—

1 **ALL-STEEL HOUSINGS.** Rugged, strong, rigid...all parts are manufactured from heavy steel plate, formed and welded in the Falk Weld Shop.

2 **LARGE OVERHUNG LOAD CAPACITY.** Large shafts, oversize bearings...rigid mountings with wide bearing spans to handle maximum applied loads.

3 **PRECISION GEARING.** Heat-treated alloy steel gearing, precision cut and shaved after heat treatment to eliminate distortion. Quiet, crown-shaved pinions.

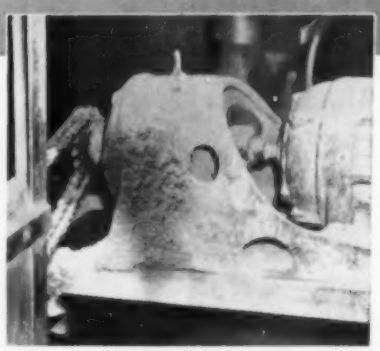
4 **EXTRA-CAPACITY GEARING.** Special extra-capacity gear-tooth form with larger contact area gives greater strength, higher load-carrying capacity.

5 **SEALED HOUSINGS.** Splashproof, dustproof, oil-tight construction. Dual closures and one-way vents keep oil in, dust and moisture out.

6 **POSITIVE LUBRICATION.** Large sump capacity...oiltight construction assures clean lubricant...revolving elements lubricated by direct dip.

When you buy or specify the All-Motor type FALK Motoreducer, you get all these—plus the tremendous advantage of full interchangeability of motors. Switch motors as desired—use any make, style or type of standard foot-mounted motor within the unit's AGMA rating—with a minimum of difficulty or "down time."

Available in sizes up to 75 hp—*with or without motor*—from convenient factory, field or distributor stocks, from coast to coast. **Write for Bulletin 3100.**



60,000 HOURS WITHOUT A FAILURE!

Sixty thousand hours is a lot of hours—but the FALK Motoreducer in the unretouched photo above has served that long without failure or need of repair.

This 3 hp unit is one of over 60 FALK Motoreducers in daily service in an Eastern plant of a large milling company, whose president says, in part:

"One of the main advantages of FALK Motoreducers is their adaptability to any motor. Reducers and motors can be easily interchanged.... Our service records confirm the wisdom of our choice of FALK equipment as our standard."

FALK ...a good name in industry

THE FALK CORPORATION, MILWAUKEE, WISCONSIN

MANUFACTURERS OF

- Motoreducers
- Speed Reducers
- Flexible Couplings
- Shaft Mounted Drives
- High Speed Drives
- Special Gear Drives
- Single Helical Gears
- Herringbone Gears
- Marine Drives
- Steel Castings
- Weldments
- Contract Machining

DOW CORNING CORPORATION

Silicone News

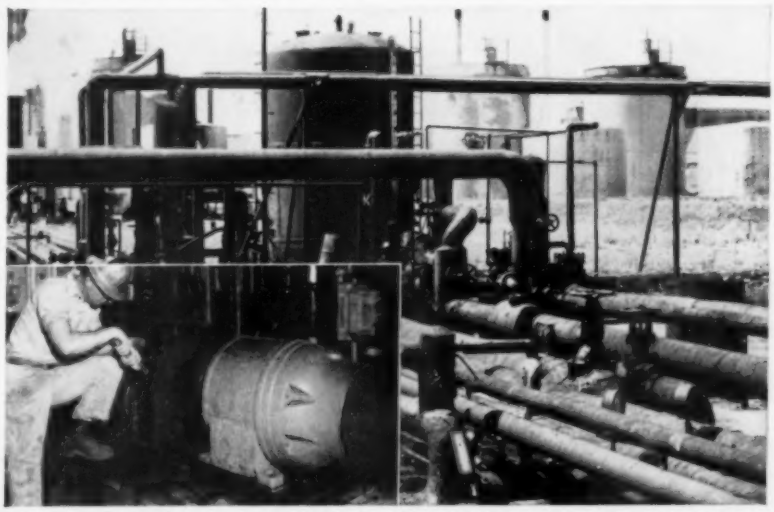
FOR PETROLEUM MEN — No. 4

END STICKING PROBLEMS

If you process a sticky product such as asphalt or synthetic rubber, the chances are you've had difficulty with it adhering to containers. Now, there's a way around the difficulty, through silicone coated paper or paperboard.

For example: a major producer of asphalt in the east switched from standard containers to silicone coated ones on the advice of its paperboard supplier. The new containers are conventional kraft folded drums, and they hold 100 pounds of asphalt. Their resistance to sticking is tremendous. The photo here illustrates how easily the container strips free . . . you can cut a "window" in it.

The company also learned that the silicone coating cut shipping weight over clay coated containers: as much as 100 pounds per 1000 drums. That means considerable saving in freight, when you consider that a carload of empty containers is some 35,000 boxes or drums. *No. 11*



GET MORE POWER FROM MOTORS

Increased flow through existing processing equipment can cause loads on motors to skyrocket. Yet these same motors, rewound with silicones, can give up to 50% more horsepower — and handle the load. Here's ten year proof:

Management of the Leonard Refineries in Alma, Michigan had a problem back in 1948. They had to step up the charge rate of crude to the refinery. But this meant that their pump motor would no longer be adequate.

At the time, they were pumping seventy-six hundred barrels a day, and needed to increase this to eighty-three hundred barrels per day. A new, larger, higher-rated motor would be required to handle the increased load. This in turn would mean new pedestal, stand, fittings and connections to accommodate the large size replacement for the 30 hp, 3600 rpm unit.

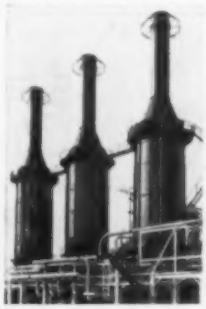
Rewinding with silicone insulation enabled them to uprate the motor 50%. Rewound ten years ago, it has been putting out more than 45 hp, 24 hours a day, ever since. Needless to add, Leonard men get their increased throughput — at a bare minimum of cost. *No. 10*

How To Eliminate Repainting Costs

Use a paint that lasts and lasts — protects surfaces so hot as to make the best conventional paints fail in short time.

The Cit-Con Oil Refinery, near Lake Charles, Louisiana, a joint enterprise of Cities Service and Continental Oil, is painted in silver and black, with the black on such hot surfaces as petrochem furnaces and boiler stacks.

However, conventional black paint lasted less than a year. So when annual shutdown time came for the steam boiler in 1952, maintenance engineers had its stacks painted with a single, brushed-on coat of a black finish by Allied Paint of Tulsa, based on Dow Corning Silicones. Later that year, all the other stacks in the plant were coated with the same finish.



Result: where formerly repainting was required every few months, the silicone finish lasts and lasts. Despite temperatures ranging from 350 to over 700 F, the silicone paint stays like new through as many as three annual shutdowns. *No. 12*

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Midland, Michigan
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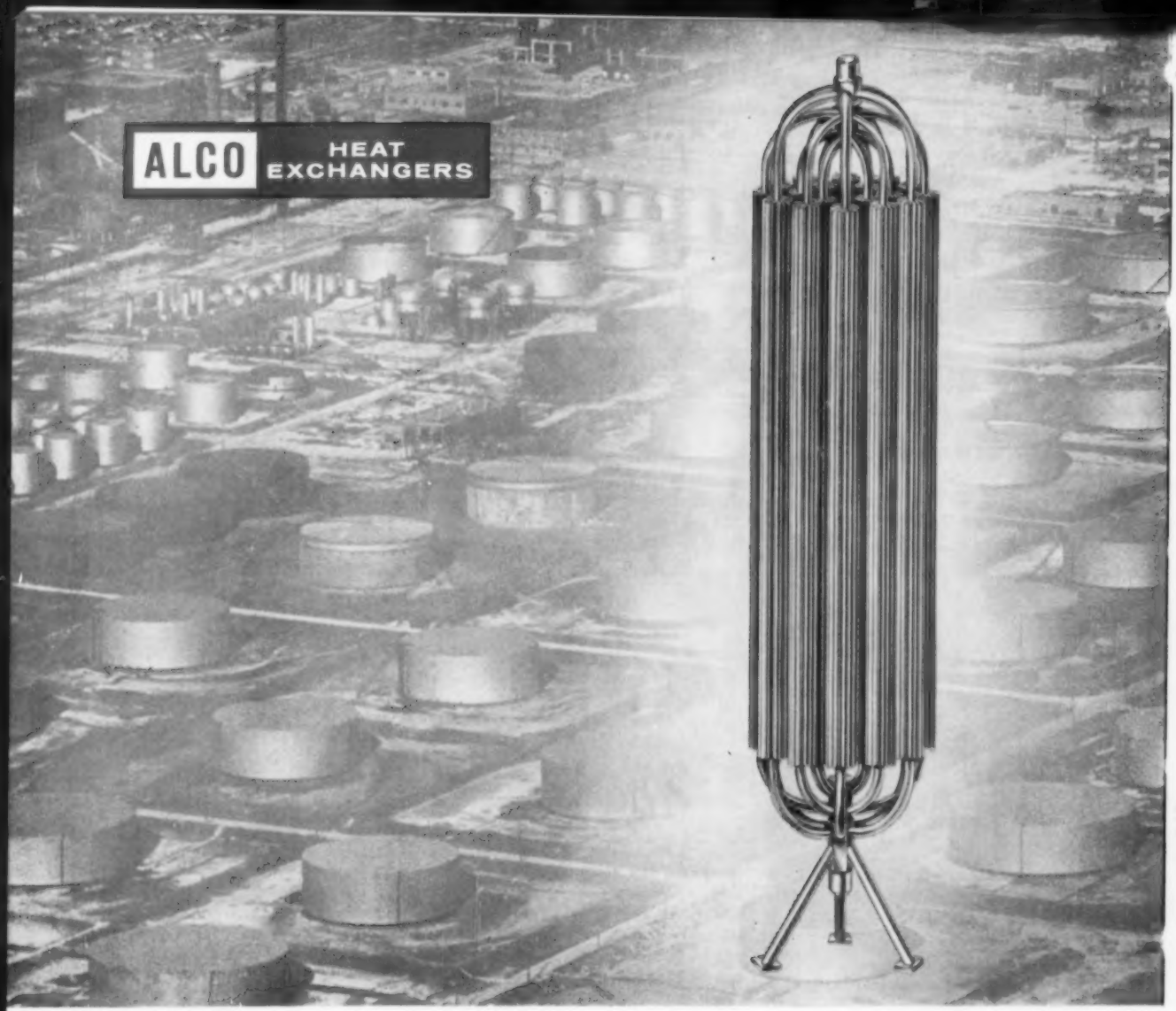
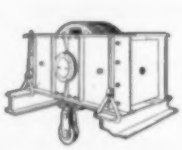
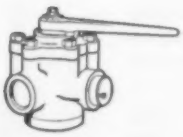
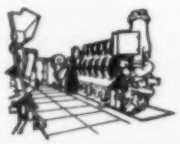
ATLANTA · BOSTON · CHICAGO · CLEVELAND · DALLAS · DETROIT · LOS ANGELES · NEW YORK · WASHINGTON, D. C.
Canada: Dow Corning Silicones Ltd., Toronto; **Great Britain:** Midland Silicones, Ltd., London; **France:** St. Gobain, Paris



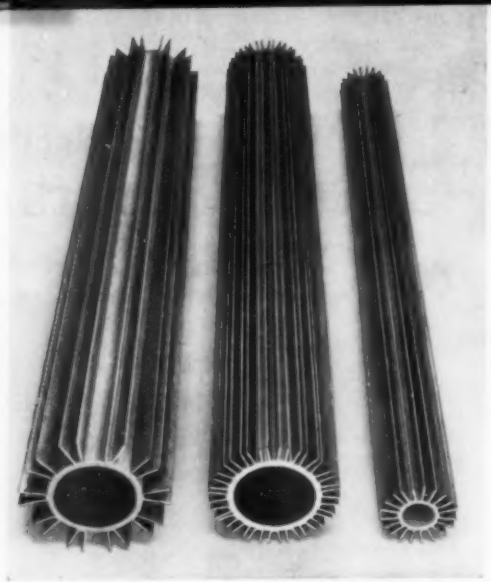
ALCOHEATER's *fin tubes provide high rate of heating for easier transport of viscous fluids. Design promotes thermal circulation. Unit can be passed through standard manhole for easy installation.*

ONLY NEW ALCO FINNED TUBES

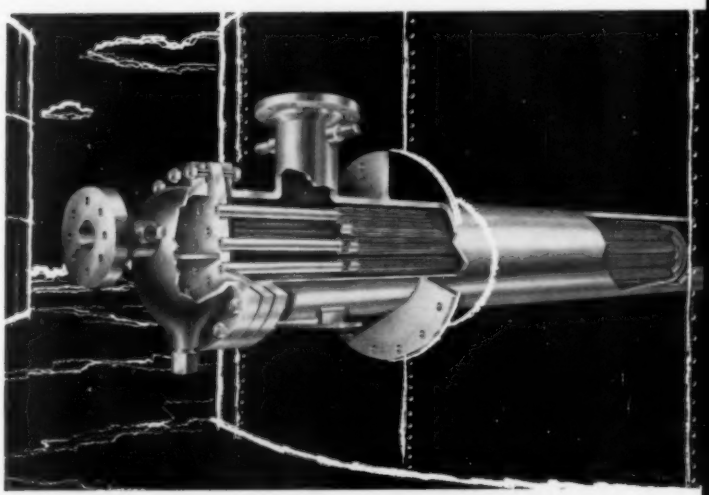


Crown and travelling blocks • *Oil-field valves* • *Wellhead equipment* • *Kinney plug injectors* • *Diesel-electric power package*



ALCO's *new welding process allows wide range of fin and tube metallurgy. Recent installation combined copper fins with Admiralty tubes.*



Tank suction heater by ALCO *uses fin tubes for straight-line heating with minimum pressure drop. Cool fin surfaces resist coking or fouling.*

MEET ALL PROCESS CONDITIONS

Using a new welding method, ALCO is producing integral fin tubes that have a higher heat-transfer efficiency. Longitudinal fins are welded to the tubes with a positive metal-to-metal union throughout their entire length. There are no spaces between fin and tube to lower heat transfer, and complete contact is assured throughout thousands of heating and cooling cycles.

ALCO is now using these improved fin tubes in exchangers like the ALCOTWIN®, ALCOHEATER and tank suction heater. The high heat-transfer rate, greater surface area, and resistance to coking or fouling combine to make these units highly efficient, flexible and easy to maintain.

The new integral fin tube is manufactured in a wide range of metallurgies for your process requirements. Complete information is available from any ALCO sales office, or write Petroleum Industry Equipment Division, Dept. 182, Bank of the Southwest Building, Houston, Tex.

ALCO

ALCO PRODUCTS, INC.
Petroleum Industry Equipment Division
HOUSTON

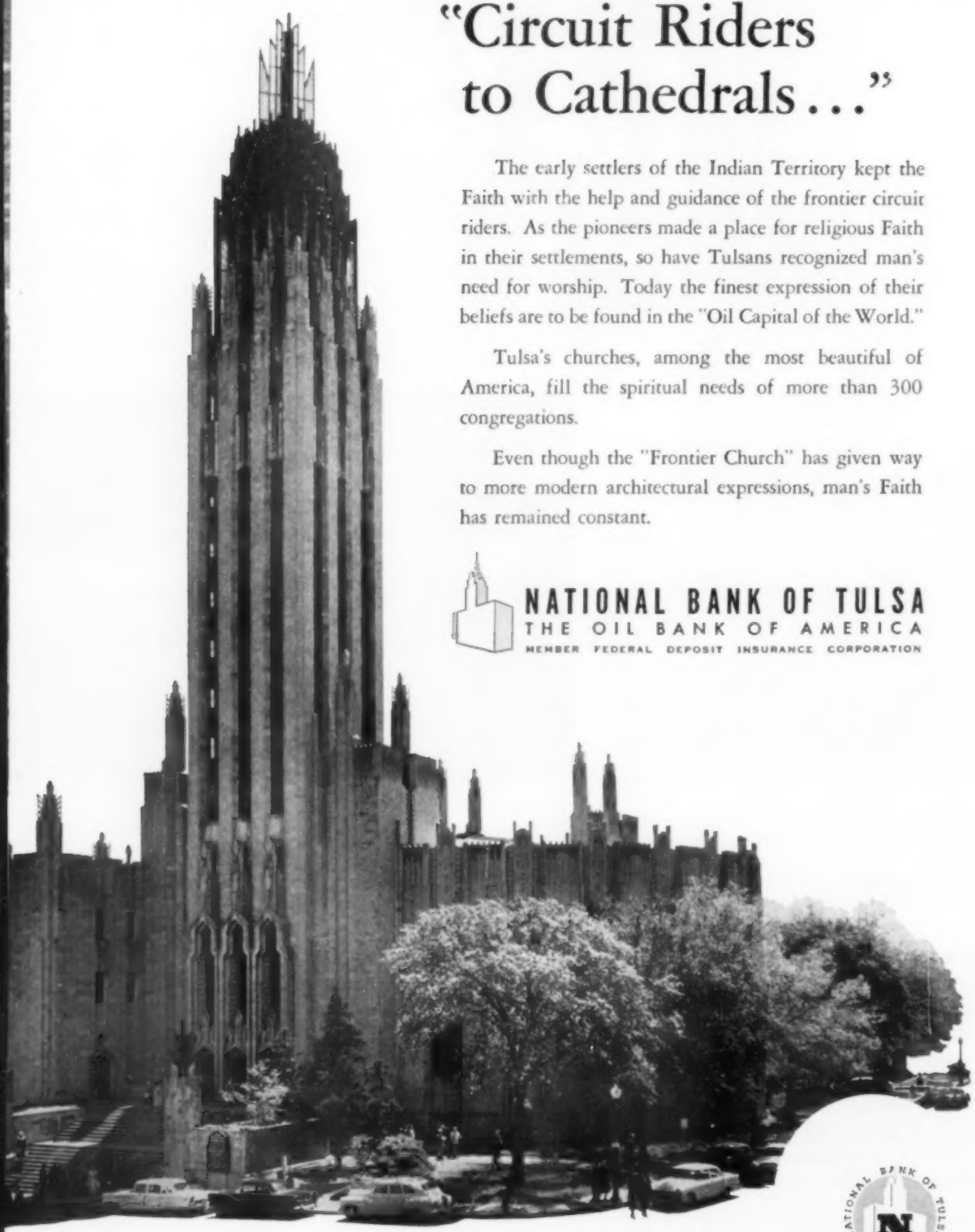
"Circuit Riders to Cathedrals..."

The early settlers of the Indian Territory kept the Faith with the help and guidance of the frontier circuit riders. As the pioneers made a place for religious Faith in their settlements, so have Tulsans recognized man's need for worship. Today the finest expression of their beliefs are to be found in the "Oil Capital of the World."

Tulsa's churches, among the most beautiful of America, fill the spiritual needs of more than 300 congregations.

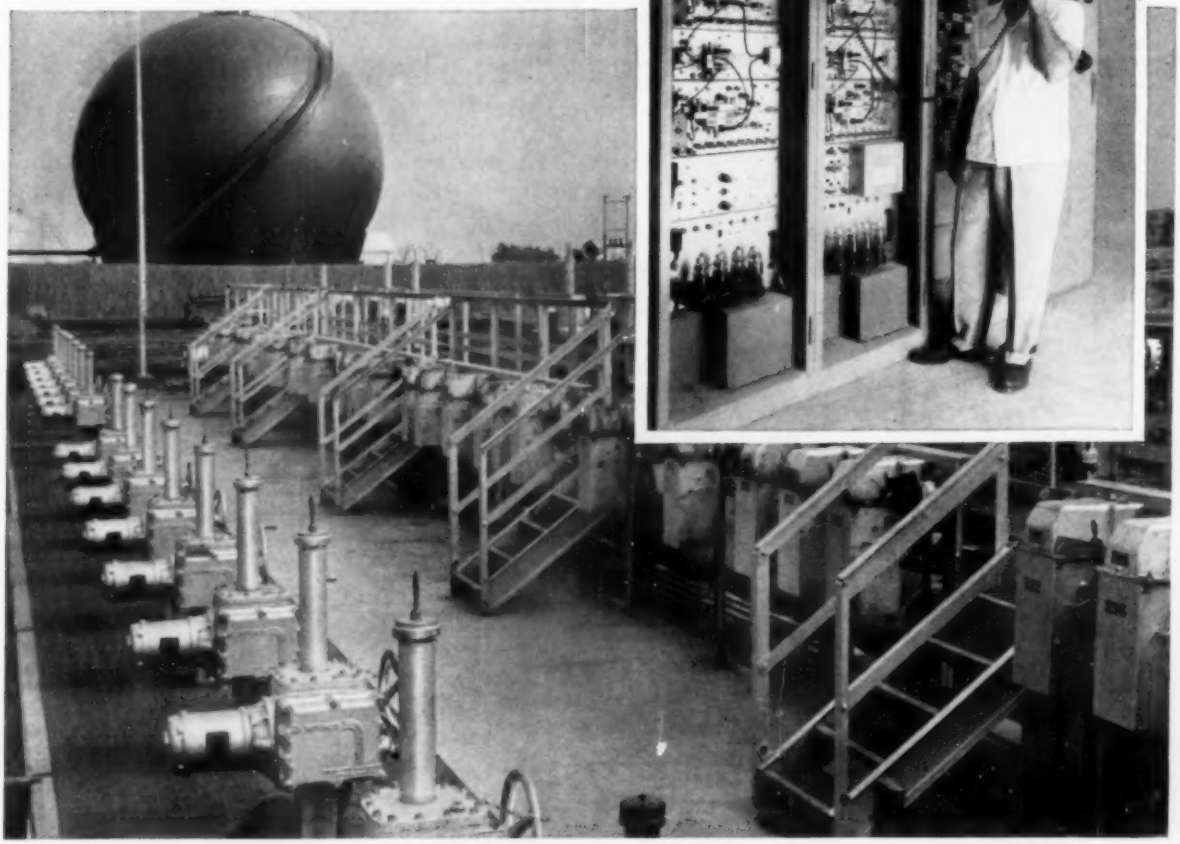
Even though the "Frontier Church" has given way to more modern architectural expressions, man's Faith has remained constant.

NATIONAL BANK OF TULSA
THE OIL BANK OF AMERICA
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION



Boston Avenue Methodist Church • Tulsa, Oklahoma

Plantation Pipeline Company has reliable control of many unattended stations with . . .



. . . Westinghouse Microwave systems and LimiTorque valve operators

With a Westinghouse Microwave Communications System and LimiTorque Remote Valve Operators, pipeline stations get not only positive control in "one complete package," but the most advanced telemetering and automatic push-button operation of valves . . . an ideal partnership for very efficient pipeline operation . . . proved by thousands of hours of actual operation. Voice panels adapt easily to any type of telephone service; telegraph units are quickly changed from one function to another.

LimiTorque Motorized Valve Operators are widely used on most all the major pipelines throughout the World; as well as in many well known refineries.

LimiTorque Operators open and close valves automatically at just the correct speed . . . and are equally effective in hot or sub-zero climates . . . safely and dependably . . . in out-of-the-way or hazardous locations . . . and LimiTorque Operation saves time and money in man hours usually expended.

Write for Catalog L-550, and you'll understand why more LimiTorque Valve Operators are used than all others combined.

LimiTorque®

PHILADELPHIA GEAR WORKS, INC.
ERIE AVE & G STREET, PHILADELPHIA 34, PENNA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Limitorque Corporation • Philadelphia

Here's a NEW WELDING TORCH that's WATERTIGHT... built for HEAVY-DUTY SERVICE ...yet weighs only 7 OUNCES!

This new HELIARC HW-18 Hand Welding Torch weighs only 7 ounces, making it easy for you to handle, less tiring. The special one-piece water cooling channel eliminates sources of leakage. And it's made for rugged, heavy-duty service.

YOU GET BETTER SHIELDING WITH LESS GAS

Improved design of collet body and closer electrode fit assure uniform argon flow, without jetting or turbulence.

GIVES YOU RUGGED SERVICE

Torch body is Fiberglas-reinforced phenolic for greater resistance to heat and thermal shock. Handle is tough, polished plastic. Gas cups have 4 times the impact strength of ordinary cups.

LEAKPROOF

Molded, one-piece water cooling passage has no joints to permit leakage—no water drip to contaminate welds.

◀ Diagram shows leakproof, one-piece water cooling passage in LINDE's new HELIARC HW-18 Hand Welding Torch.

EASY, MORE ECONOMICAL MAINTENANCE

Collets, collet bodies, cups and caps are interchangeable with those of your HW-17 Series 2 Torch. All couplings have standard IAA connections, and adaptors are included. Your production costs are lowered, too, for the new HW-18 saves time in hard-to-reach spots. Torch is designed for continuous 300-amp service, a-c or d-c.

ARGON SHUT-OFF VALVE

(Optional) saves time, steps and argon.

See and try this new HELIARC HW-18 Torch! For a demonstration, mail coupon today. Or call your distributor or nearest LINDE office. LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. Offices in other principal cities. In Canada: Linde Company, Division of Union Carbide Canada Limited.

Dept. 0-53, LINDE COMPANY, Division of UCC
30 East 42nd Street, New York 17, N. Y.

Please advise me where and when I can examine and try out the new HELIARC HW-18 Hand Welding Torch.

NAME_____

COMPANY_____

STREET_____

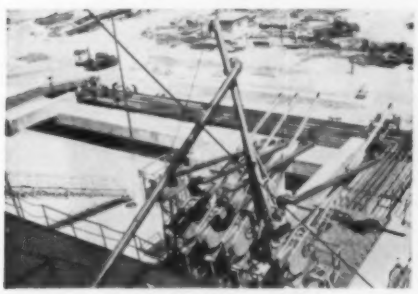
CITY_____ ZONE____ STATE_____

FOR THE BEST IN ELECTRIC WELDING LOOK TO Linde TRADE-MARK

UNION CARBIDE

The terms "Linde," "Heliarc," and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

RICHFIELD INSTALLS NUMBER FOUR



Where once seven men labored 30 minutes to hook up rubber hose, now one man operating hydraulic controls swings a Chiksan Loading Arm aboard, ready for hook up, in less than a minute. There are 96 Chiksan Marine Loading Arms in service throughout the world. Many more are on order.

Richfield, like other users who are reordering, has installed still another bank of Chiksan Marine Loading Arms.

The first bank of Chiksan Marine Loading Arms on the West Coast went into service at Richfield's Terminal No. 2 in May, 1956. Subsequently, two additional banks of five were installed to render the facility among the most modern anywhere. This terminal has since handled over 50 million barrels of crude and refined products of many grades. Now, with growing need for greater transfer capacity, Richfield has ordered and installed an additional bank of three arms.

On every count, Safety, Economy, Speed, the Chiksan Marine Loading Arm measures up. So substantial are the savings gained from faster loading, greatly reduced replacement costs, fewer loss-time injuries, and elimination of rupture potential, that in many cases these savings can easily amount to the actual purchase price within three years.

Send for informative bulletin and payout analysis today.

fmc

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

CHIKSAN

CHIKSAN COMPANY—BREA, CALIFORNIA • CHICAGO 5, ILLINOIS • NEWARK 2, NEW JERSEY

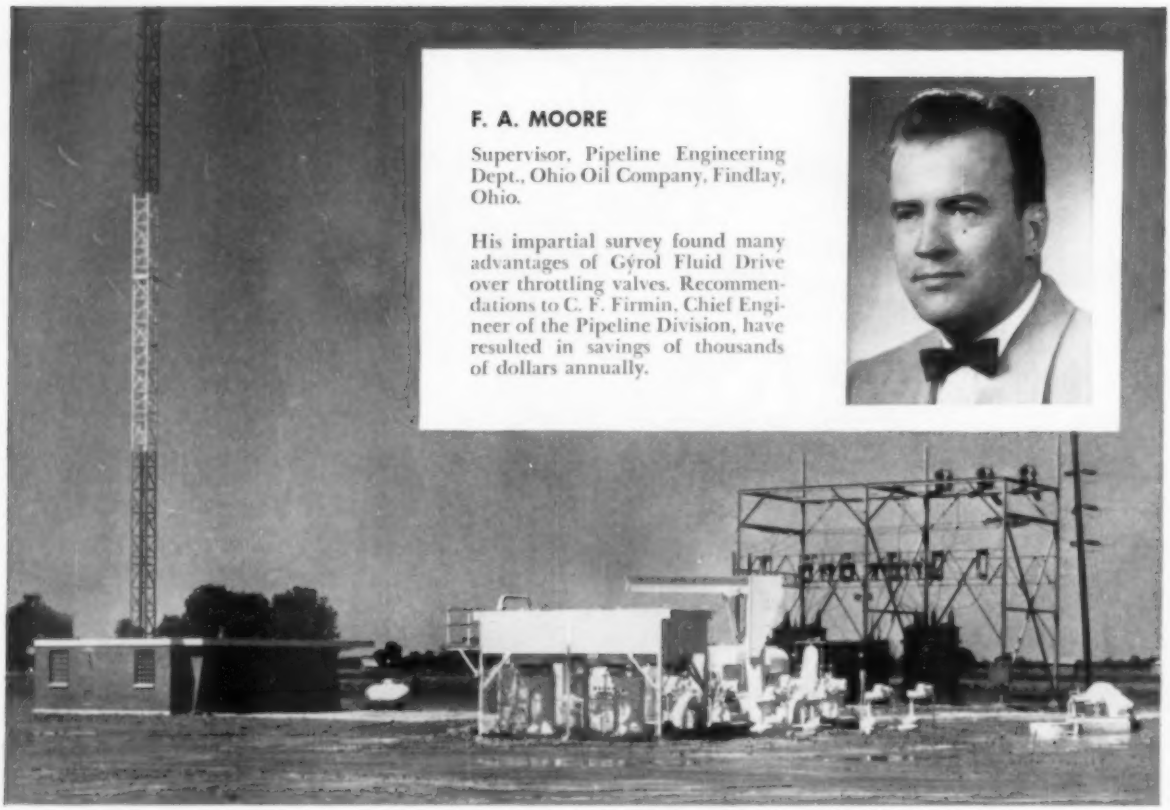
Weil Equipment Mfg. Corp. (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Company • Chiksan of Canada, Ltd.

#58-33

MARATHON

AMERICAN BLOWER *Gyrol*® Fluid Drive

REDUCE PIPELINE

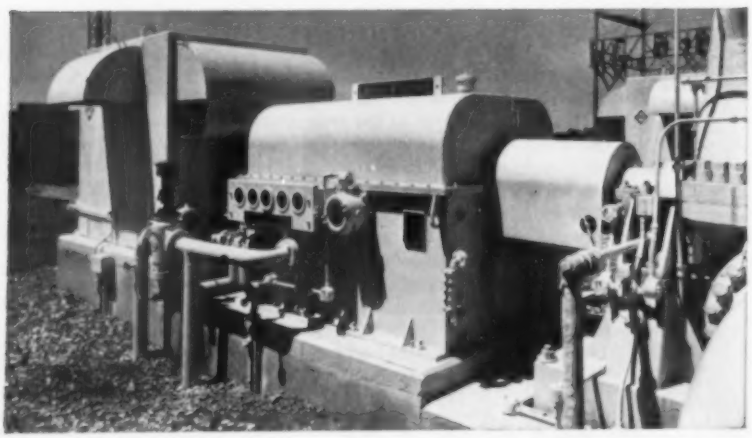


F. A. MOORE

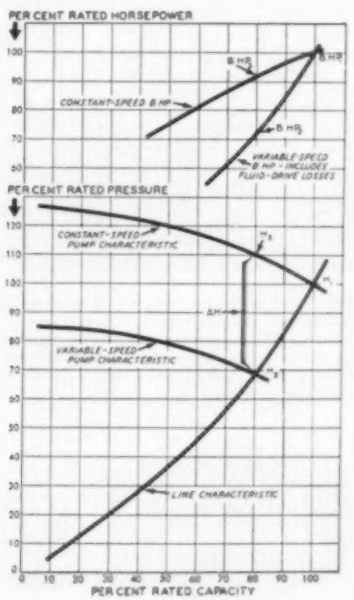
Supervisor, Pipeline Engineering Dept., Ohio Oil Company, Findlay, Ohio.

His impartial survey found many advantages of Gyrol Fluid Drive over throttling valves. Recommendations to C. F. Firmin, Chief Engineer of the Pipeline Division, have resulted in savings of thousands of dollars annually.

Ohio Oil's Roachdale, Ind., pumping station.



Gyrol Fluid Drive is installed outdoors at the Roachdale station, an automatic, unattended crude-oil booster station. The unit pictured consists of a 2,500-hp 1,800-rpm motor, a class 6 Gyrol Fluid Drive, and a centrifugal pump.



Graph shows how pump BHP varies as the cube of the speed, while Gyrol Fluid Drive efficiency varies directly as the ratio of output to input speed. Result: major power savings over throttling whenever pump runs below full speed.

helps Ohio Oil Company

POWER COSTS 10%-25%!

Adjustable-speed *Gýrol*® Fluid Drive saves power; gives complete flexibility of flow and pressure

Power savings of $10,000-$12,000 *annually* have resulted since Ohio Oil Company, Findlay, Ohio, equipped its Jewett, Ill., automatic pumping station with American Blower Gýrol Fluid Drive.

Infinitely adjustable in speed, Gýrol Fluid Drive controls flow and pressure in a 10-in. closed-system products line. By eliminating wasteful throttling, it maintains throughput with lowest possible power consumption.

An 8-stage centrifugal pump is driven by a 900-hp, 3,600-rpm induction motor through Gýrol Fluid Drive. This combination brings these operating benefits:

- Single unit provides complete flexibility, regardless of rate of flow required by changes in viscosity or specific gravity.
- Motor starts under no-load conditions, reducing "soft line" demand charges.
- Pressure surges in line are eliminated.

In addition, American Blower Gýrol Fluid Drive:

- Holds pressure below design pressure of line.
- Maintains minimum suction pressure.
- Adapts easily to unattended operation.
- Offers dependability proved by hundreds of continuous-duty pump applications.

For full information on the pipeline-pumping savings possible with Gýrol Fluid Drive, contact one of our 73 branch offices. Or write: American-Standard*, American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

Dependable Gýrol Fluid Drives have satisfied the automation needs of power plants for years; are ideal for remote-controlled pumping stations. Class 6 Gýrol Fluid Drives are available from 250 hp to 12,000 hp; speeds to 3,600 rpm.

* American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation.

Gýrol Fluid Drive Dept. 10
American-Standard
American Blower Division
Detroit 32, Michigan

Gentlemen:

☐ Please send information on Gýrol Fluid Drive for pipeline pumping stations; ☐ Have an American Blower representative call.

Name_____

Title_____

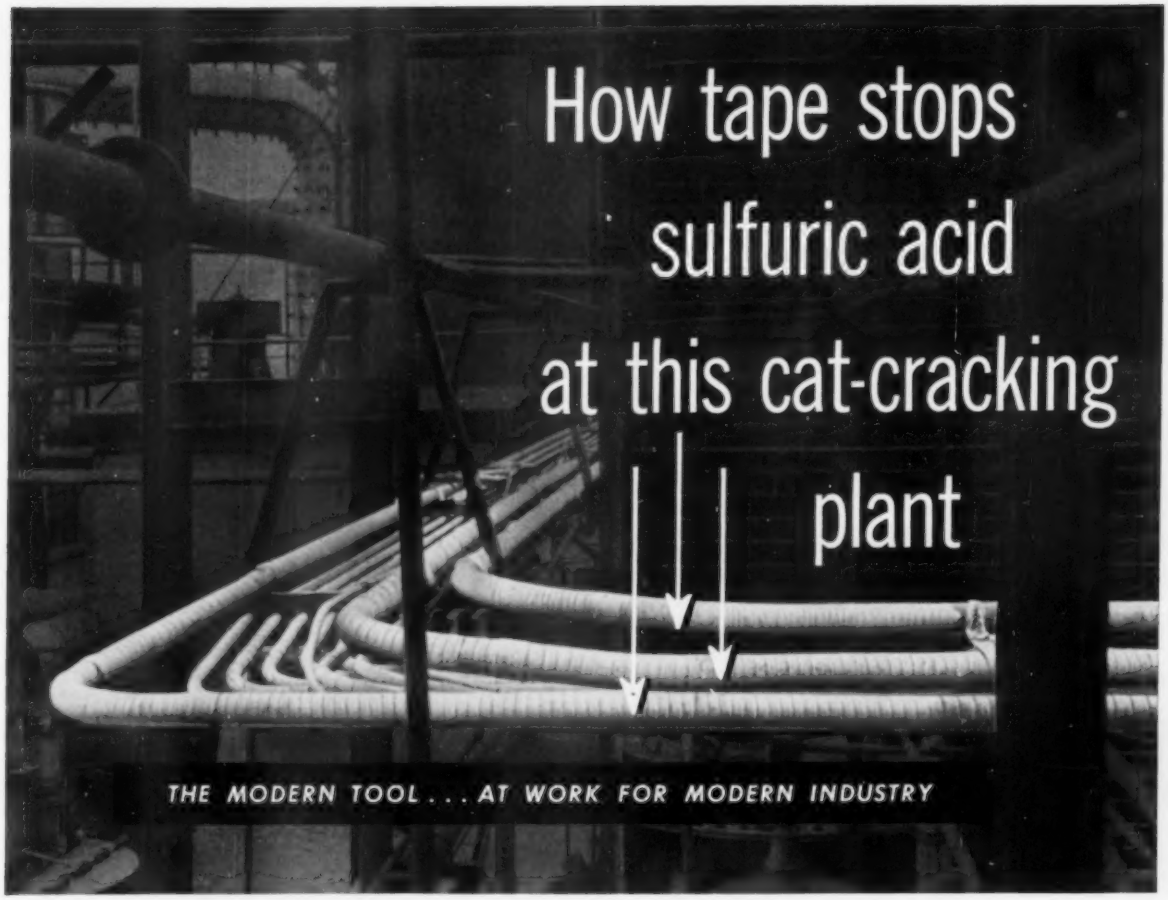
Company_____

Address_____

City_____ Zone_____ State_____

AMERICAN-Standard
AMERICAN BLOWER DIVISION

An oilman belongs at every table. Pipeliners—in fact, *all* oilmen—help set the family table. Oil-based insecticides, fertilizers and animal medicines help bring better fruits, vegetables and meats to market. And with an oil-powered tractor, a farmer can do the work of ten men, ten horses, five hand plows. Sometimes people who know little about oil talk loudly against our industry. That's when we oilmen should point out that at home, as elsewhere, oil serves people well. **SHELL OIL COMPANY**



FIVE YEARS UNDER THESE HIGHLY CORROSIVE CONDITIONS PROVES THAT POLYKEN PROTECTION WORKS . . . *TO TRIM COSTS*

Look in on one of the world's largest fluid catalytic cracking units. A maze of conduit and pipe exposed to an extremely corrosive sulfuric acid atmosphere.

Formerly, these structures had to be painted every three or four months. Maintenance costs were excessive. Then, five years ago, they were wrapped with Polyken Protective Tape Coating. They have needed practically no attention since.

INERT POLYETHYLENE

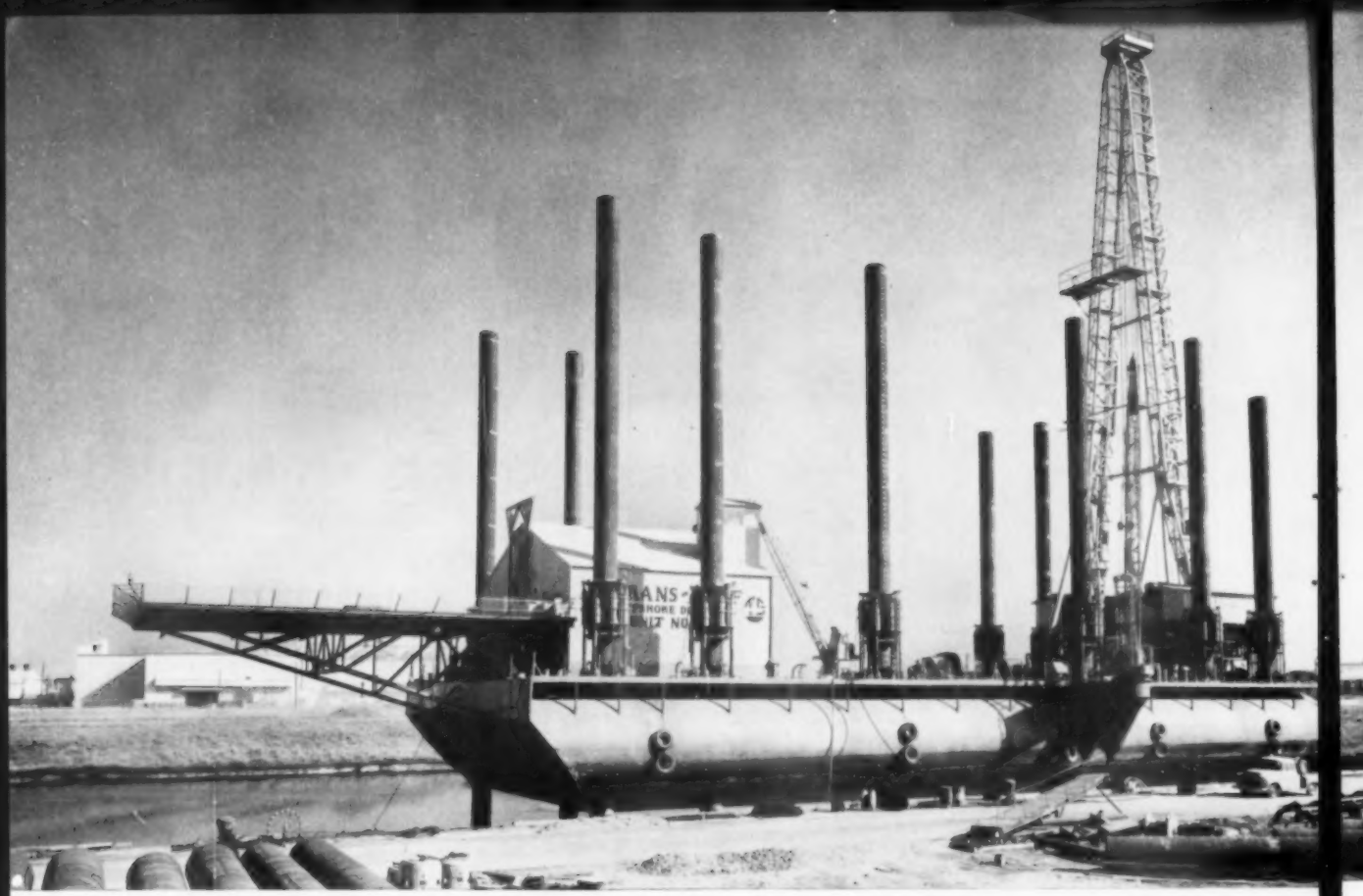
The reason is that Polyken takes amazingly inert polyethylene and makes it into a tape coating with all these properties.

- **tough and elastic**
- **unplasticized, non-drying film**
- **doubly thick adhesive to seal all voids**
- **far higher adhesion for a true bond to pipe surface**
- **lower water vapor transmission rate**
- **higher electrical insulation resistance**
- **better cold weather handling and durability**

Check the savings. Contact the Polyken distributor in your area.

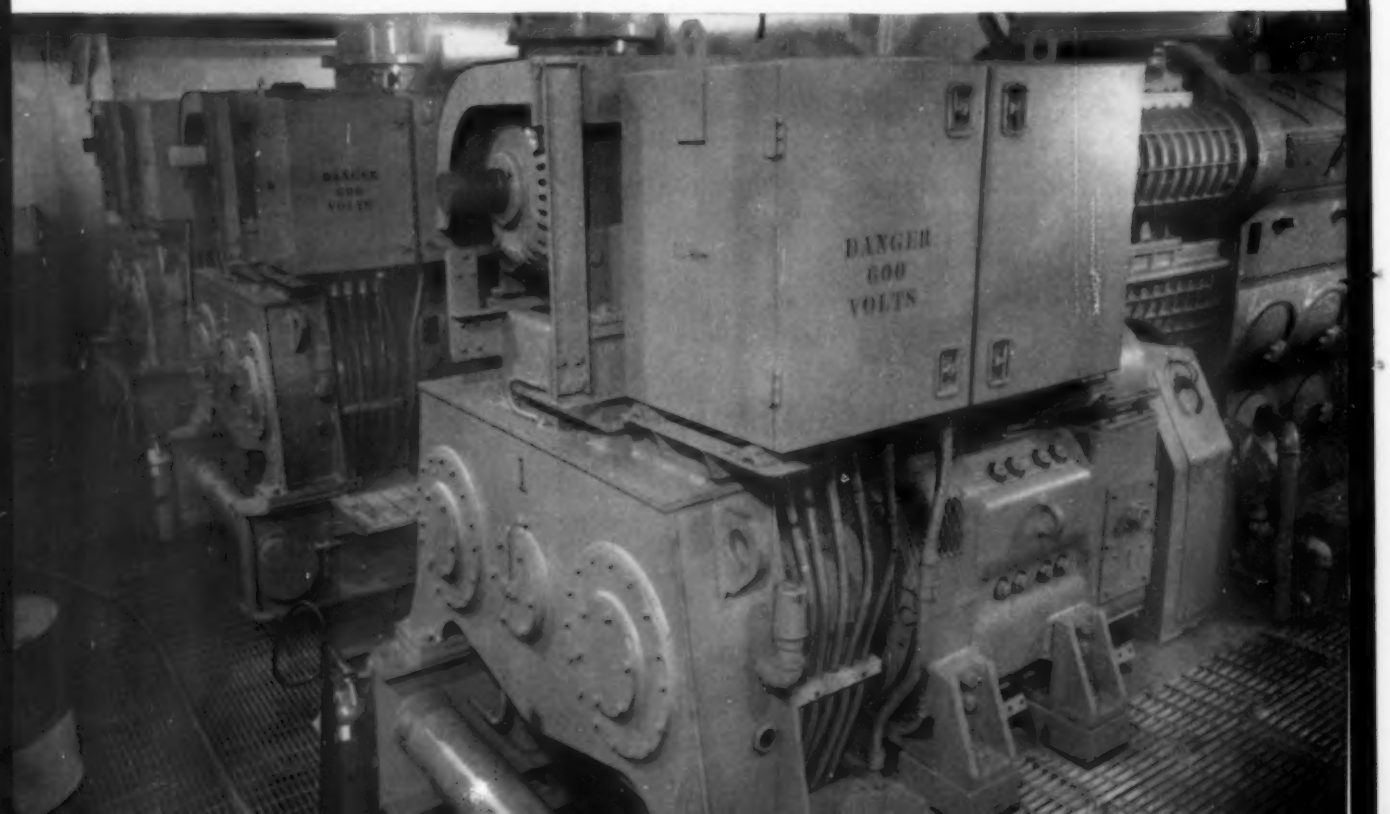
Atlanta, Georgia: Steele & Associates, Inc.
Chicago, Ill: Sales Engineering, Inc.
Cincinnati, Ohio: Hare Equipment
Cleveland, Ohio: The Harco Corp.
Des Moines, Ia.: The Donald Corp.
Fort Worth, Texas: Plastic Engineering & Sales Corp.
Harvey, La.: Allen Cathodic Protection Co.
Houston, Texas: Cathodic Protection Service.
Kansas City, Mo.: Industrial Coating's Engineering Co.
Long Beach, Calif.: Barnes & Delaney
Minneapolis, Minn.: Simcoe Equipment Co.
Oakland, Calif.: Bison Co.
Philadelphia, Pa.: Harold N. Davis Co.
Pittsburgh, Pa.: Royston Laboratories, Inc.
Plainfield, New Jersey: Stuart Steel Protection Corp.
St. Louis, Mo.: Shutt Process Equipment Corp.
San Francisco, Calif.: Aetna Sales Co.
Seattle, Wash.: Farwest Corrosion Control Corp.
Seattle, Wash.: Pacific Water Works Supply Co.
Tulsa, Okla.: William Cluff Corp.

Polyken®
Experienced in modern PROTECTIVE COATING
THE KENDALL COMPANY
Polyken Sales Division



The huge mast on Trans-Gulf's new mobile rig towers 143 feet above the deck. Hydraulically operated legs, each 210 feet long, permit drilling in 75 feet of water. A two-story crew quarters is located on the bow main deck.

Three Electro-Motive engine generator sets of 1000-hp are located in the hull which leaves the deck clear of power equipment. Mud pumps, each powered by two 625-hp electric drive motors are also located below deck.



TRANS-GULF RIG No. 10 is Electro-Motive Powered

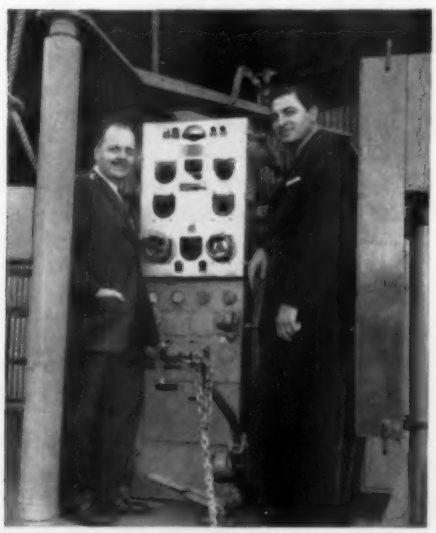
Trans-Gulf No. 10 ranks among the largest rigs in drilling capacity—25,000 feet. Yet, by offshore measurements it is very compact, a design that was accomplished by placing major power equipment in the hull. High cost deck space was held to a minimum without sacrifice of drilling efficiency or accommodations for the crew of forty-two. Deck measures only 87 by 185 feet.

In both control and design, Electro-Motive Power provided cost-saving answers for Trans-Gulf. The standardized components of this power system give complete freedom of equipment arrangement. Standardization also means simplified engineering. You have only *one* manufacturing responsibility for *both* electrical and mechanical components on installation and for service.

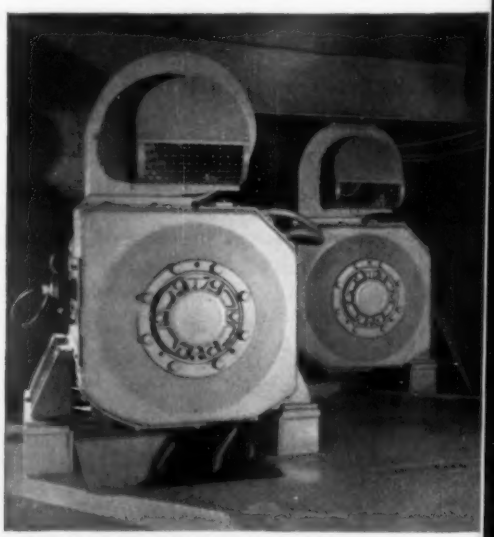
ELECTRO-MOTIVE DIVISION · GENERAL MOTORS

LA GRANGE, ILLINOIS • *In Canada:* General Motors Diesel Limited, London, Ontario

Petroleum industry sales offices: Dallas, Houston, Texas; New Orleans, Louisiana; Los Angeles, California



Inspecting the control console at the driller's station is William Flynn, (right), Vice President of Trans-Gulf. With him is Electro-Motive representative Art Hazell.



Two of the three 625-hp electric drive motors for the big 2500-hp IDECO draw works are shown in their mountings underneath the hoist. This unique arrangement conserves valuable deck space.

look for this → symbol

...it identifies all Dresser Companies and their products

CLARK CLARK BROS. CO. compressors	IDECO DRESSER-IDECO COMPANY steel structures	DRESSER DRESSER MANUFACTURING DIVISION couplings	GUIBERSON THE GUIBERSON CORPORATION oil tools
IDECO IDECO drillings rigs	LANE WELLS LANE-WELLS COMPANY technical oilfield services	Magcobar MAGNET COVE BARIUM CORP. drilling mud	PACIFIC PACIFIC PUMPS, INC. pumps
ROOTS-CONNERSVILLE BLOWER DIVISION blowers	Security SECURITY ENGINEERING DIVISION drilling bits	SIE SOUTHWESTERN INDUSTRIAL ELECTRONICS electronic instrumentation	WELL SURVEYS WELL SURVEYS, INC. nuclear and electronic research

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You gain an important extra plus value every time you are served by any of the Dresser companies. This is the unique way Dresser operates to serve you better. Each Dresser company works independently to assure maximum individual attention to your specific needs . . . yet all are teamed together in a single organization to provide a group of research, engineering, and manufacturing services. From Dresser you obtain equipment based on the over-all experience of many companies in many industries.

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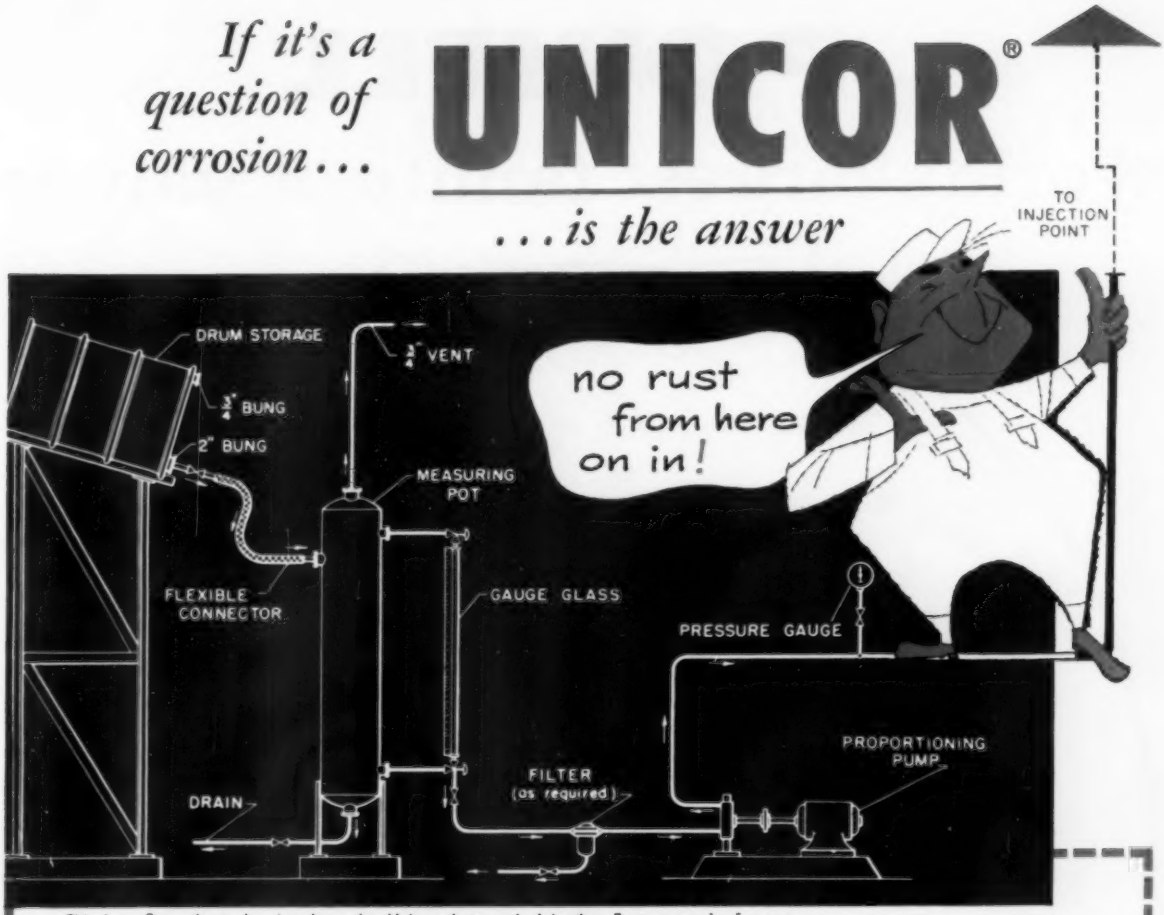
Tomorrow's Progress Planned Today

If it's a question of corrosion...

UNICOR®

...is the answer



This is a flow chart showing how the Unicor Automatic Injection System works for you.

Question: *How can we eliminate serious filter fouling in blending tank caused by formation of highly peptized iron rust during processing?*

Answer: UOP's Unicor corrosion inhibitor solved this problem for a large southern refiner not long ago. Before Unicor application, a yard-square panel of the tank interior was sandblasted down to bare metal to test Unicor's effectiveness. After several months of injection in the rundown line, this test panel was completely free of corrosion, the remainder of tank interior was free of filter-fouling rust.

Question: *Is addition of water necessary?*

Answer: No. Unicor is oil soluble. It also prevents rusting caused by unavoidably entrained or dissolved moisture.

Question: *Should Unicor be injected only in the rundown line?*

Answer: Unicor can be injected at any point in your process. The refiner mentioned above shifted the Unicor injection point from the rundown line to his crude fractionator overhead and in catalytic gasoline from the main column overhead receiver. This extended Unicor's protection to heat exchangers, condensers and towers between new injection points and blending tank. Unicor inhibits corrosion in all your processing equipment from the point of injection on . . . even to consumer equipment.

Question: *How much does Unicor cost?*

Answer: About $0.001 or a tenth of a cent per bbl. of product in normal application.

Let us send you samples of

UNICOR

for testing in your own laboratories.

UOP®

UNIVERSAL OIL PRODUCTS COMPANY
30 ALGONQUIN ROAD
DES PLAINES, ILLINOIS, U.S.A.

POWELL

world's largest family of valves

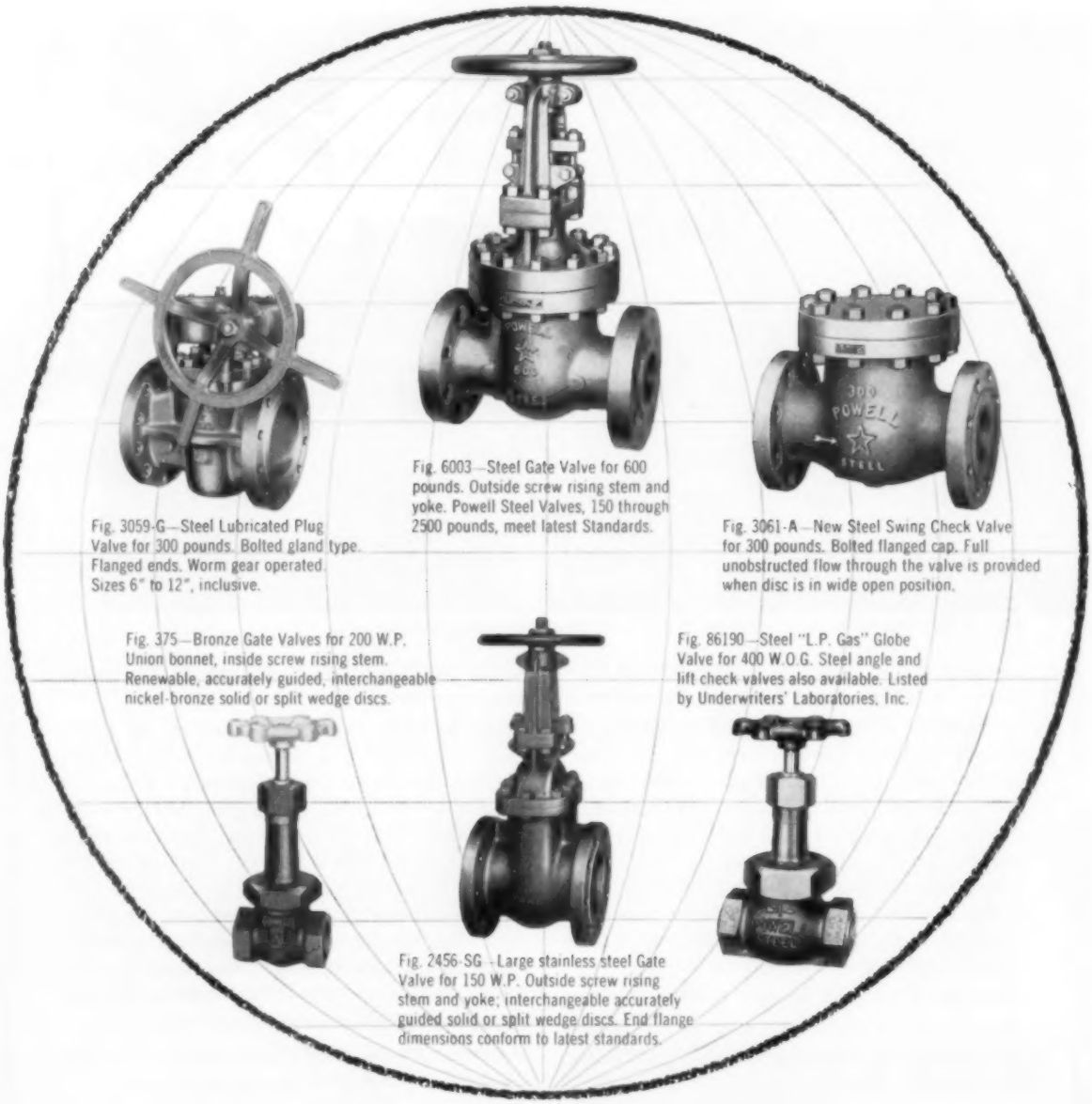


Fig. 3059-G—Steel Lubricated Plug Valve for 300 pounds. Bolted gland type. Flanged ends. Worm gear operated. Sizes 6" to 12", inclusive.

Fig. 6003—Steel Gate Valve for 600 pounds. Outside screw rising stem and yoke. Powell Steel Valves, 150 through 2500 pounds, meet latest Standards.

Fig. 3061-A—New Steel Swing Check Valve for 300 pounds. Bolted flanged cap. Full unobstructed flow through the valve is provided when disc is in wide open position.

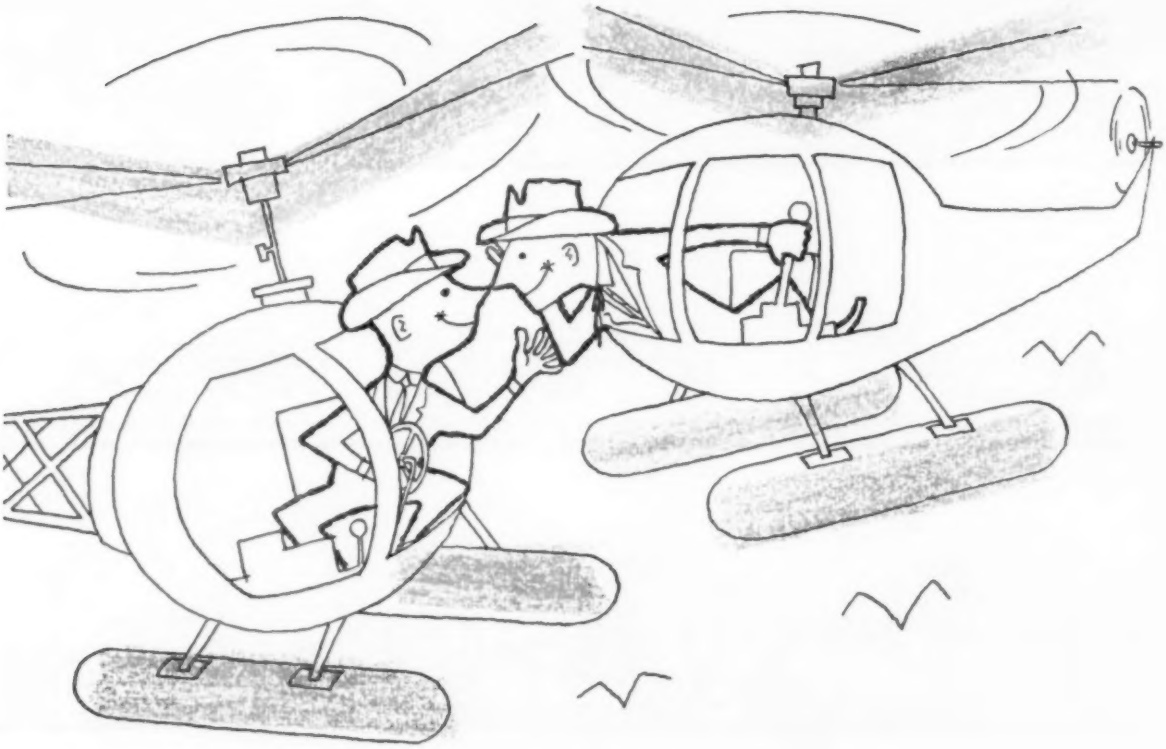
Fig. 375—Bronze Gate Valves for 200 W.P. Union bonnet, inside screw rising stem. Renewable, accurately guided, interchangeable nickel-bronze solid or split wedge discs.

Fig. 86190—Steel "L.P. Gas" Globe Valve for 400 W.O.G. Steel angle and lift check valves also available. Listed by Underwriters' Laboratories, Inc.

Fig. 2456-SG—Large stainless steel Gate Valve for 150 W.P. Outside screw rising stem and yoke; interchangeable accurately guided solid or split wedge discs. End flange dimensions conform to latest standards.

A solution for every kind of flow control problem is as near as your local Powell distributor. Powell valves are designed and engineered in the largest variety of metals and alloys, to handle any medium, every flow control requirement. There are Powell distributors in all principal cities. Or, if yours is a special engineering problem, write to:

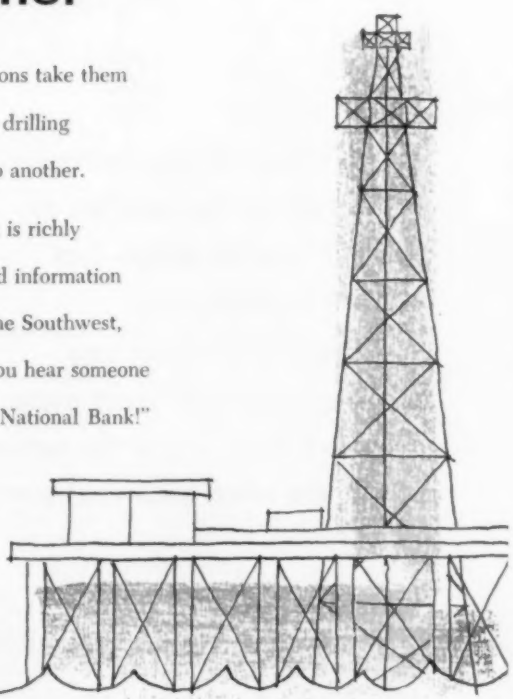
THE WM. POWELL COMPANY • *Dependable Valves Since 1846* • **Cincinnati 22, Ohio**



"Wherever oil men gather"

● Oil men get around a lot. Their operations take them to field offices, to remote lands, to offshore drilling platforms . . . from one center of activity to another.

When they get together, their conversation is richly colored with the specialized knowledge and information characteristic of their profession. And, in the Southwest, wherever oil men gather, more and more you hear someone say, "For *my* money, it's The Fort Worth National Bank!"



85th SINCE 1873 ANNIVERSARY

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Helping Build a Greater Fort Worth and Southwest

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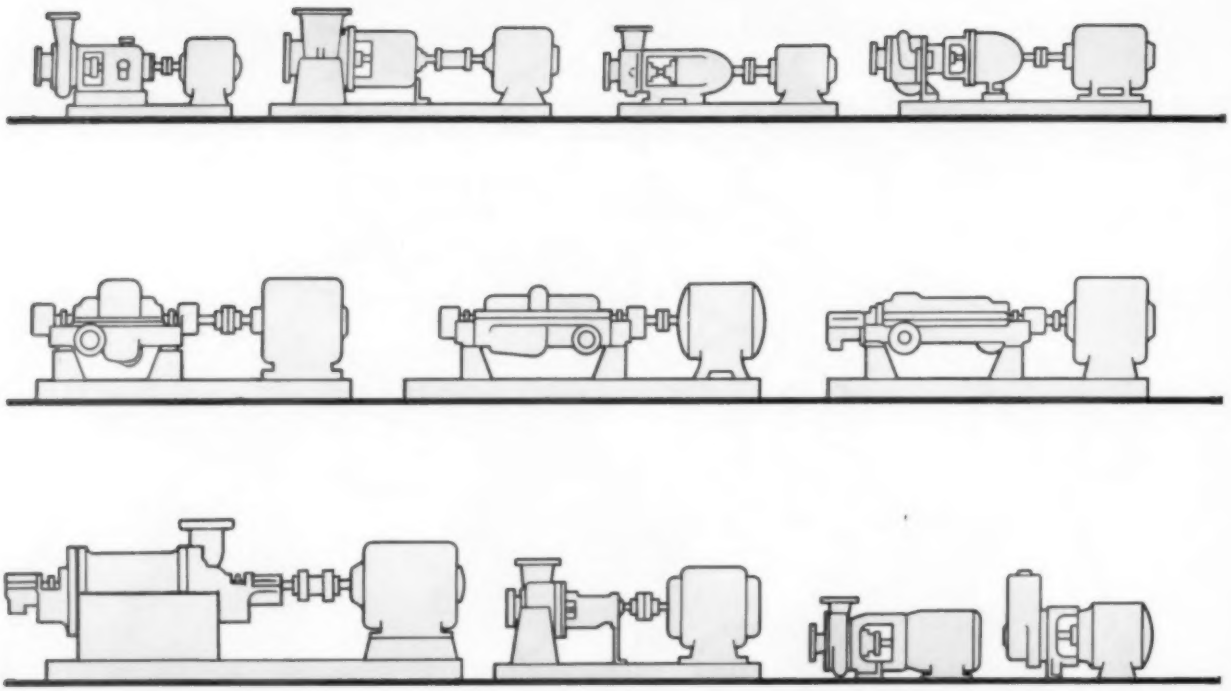
CAPITAL AND RESERVE ACCOUNTS OVER $20 MILLION



Which one is the right pump for

The efficiency of your entire process can depend on the selection of the right process pumps... or even on a single pump.

Here are five questions you should ask yourself about pump manufacturers... know the answers before you select your next pump.

1 *Who has the most complete line?*

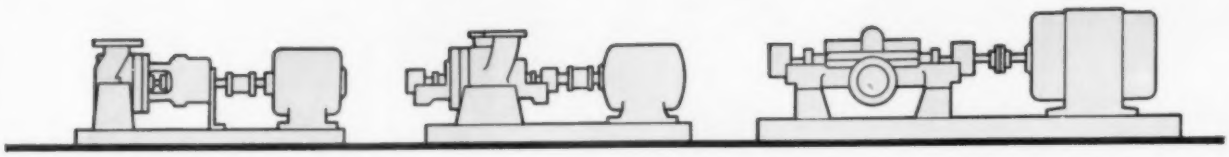
It's a fact that Ingersoll-Rand makes the most complete line of centrifugal pumps available from any single source. Often I-R is the only supplier who can quote on all the centrifugal pumps needed for a new processing plant. For that reason you benefit in two ways: The I-R engineer will be completely unbiased in helping you select the right pumps, and you get the advantages of *undivided responsibility* for all your pump requirements.

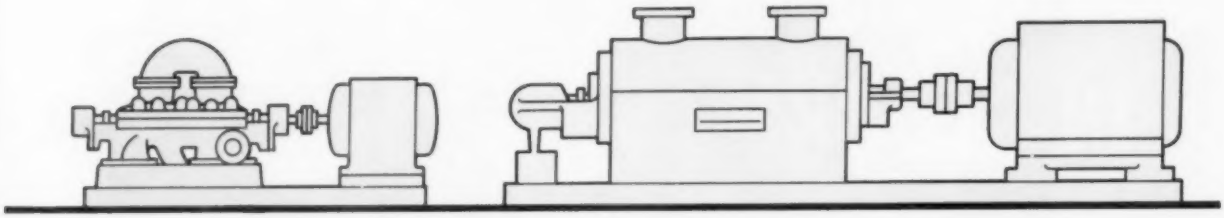
2 *What if I need a "special" pump?*

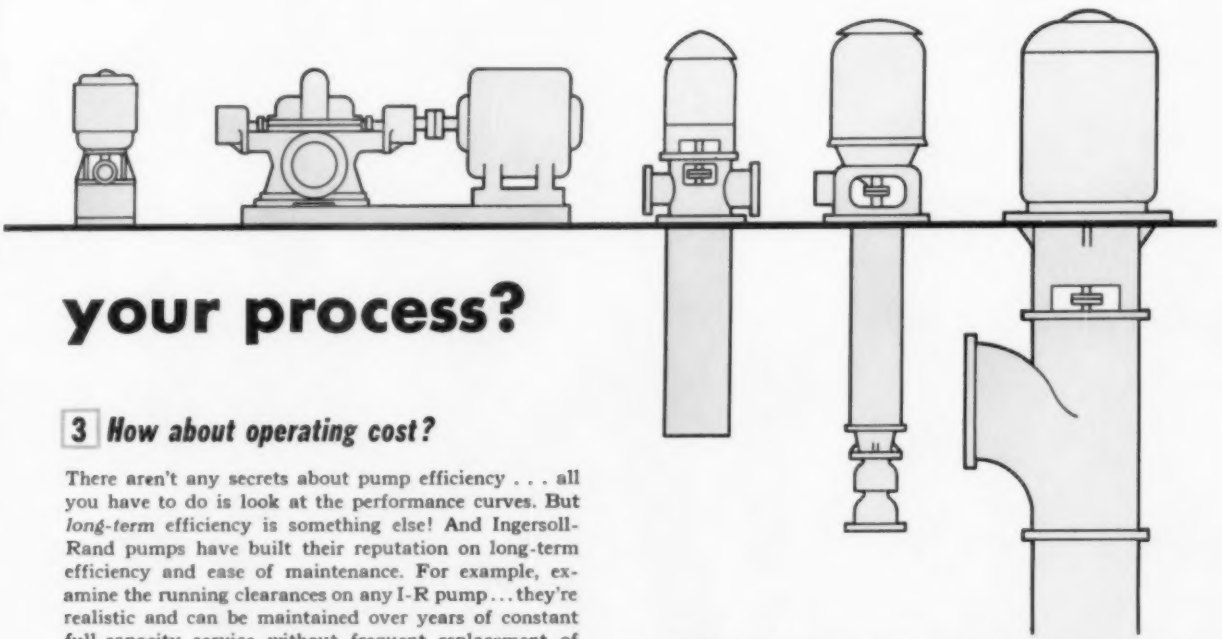
Despite the unequalled completeness of the I-R line (a few of the hundreds of types and sizes are sketched above), there are occasions when a standard pump won't do the job properly. Here's where Ingersoll-Rand's long experience pays off. If the right pump doesn't exist, I-R will build it! This is another reason why you're always sure to get the right pump for the job from I-R.

There's no substitute for

COMPRESSORS · PUMPS · DIESEL ENGINES · AIR & ELECTRIC TOOLS · TURBO BLOWERS · CONDENSERS







your process?

3 How about operating cost?

There aren't any secrets about pump efficiency . . . all you have to do is look at the performance curves. But *long-term* efficiency is something else! And Ingersoll-Rand pumps have built their reputation on long-term efficiency and ease of maintenance. For example, examine the running clearances on any I-R pump . . . they're realistic and can be maintained over years of constant full-capacity service without frequent replacement of wearing parts.

4 How about parts interchangeability?

The record speaks for itself . . . you can inspect and compare charts which spell out the degree of interchangeability of parts in each class of I-R pumps. I-R works constantly to standardize parts and thereby reduce your spare parts inventory.

5 And how about engineering services?

Without obligation on your part, I-R pump specialists will evaluate your process requirements and make constructive suggestions on pump selection. Elevation prints and performance curves will be provided to help you with mechanical and hydraulic design problems. Manufacturing that is coordinated with your requirements means that you get delivery when you want it. And Field Erection Service is always available, to assure proper installation . . . *on time.*

experience in engineered products

Ingersoll-Rand

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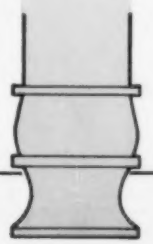
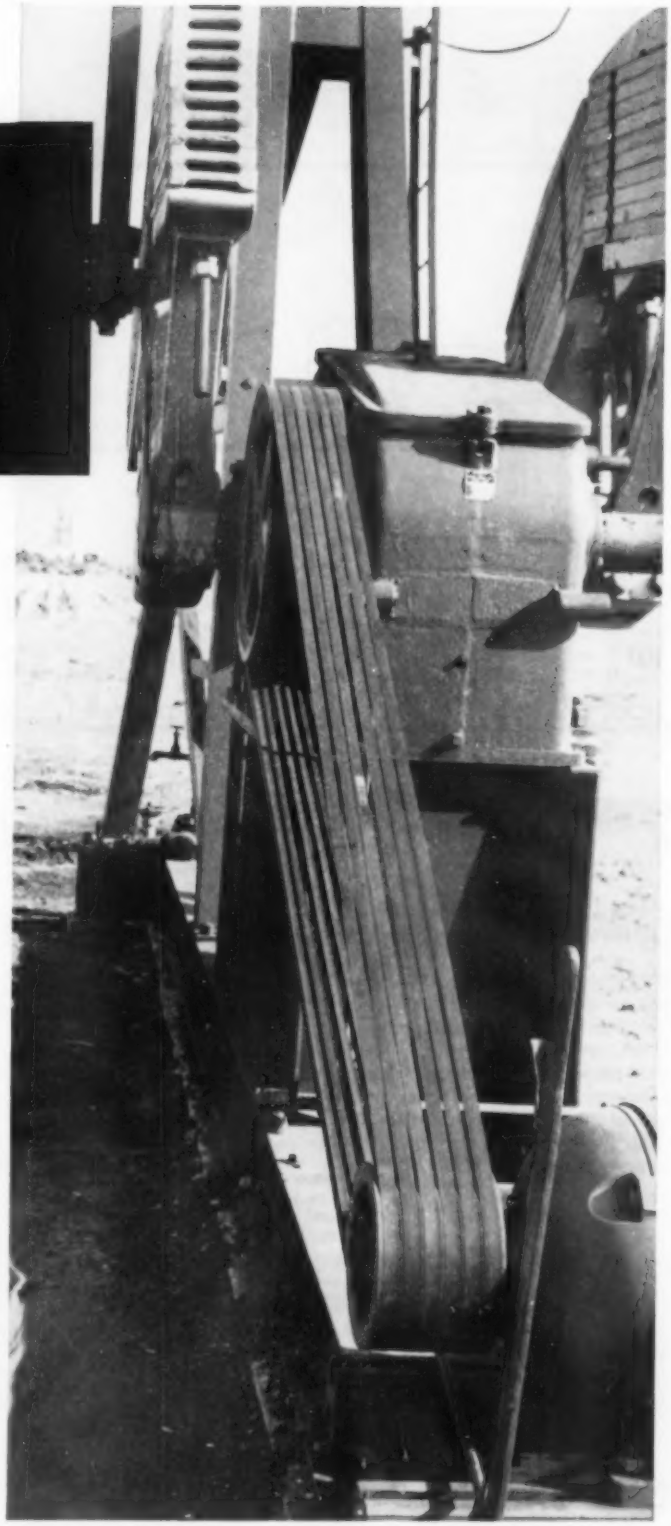


"Yes, It's IN STOCK"



● Those are wonderful words when you need a belt in a hurry. Yet, they are the rule rather than the exception when you call the Republic Oil Field Distributor in your field. He has a warehouse near you where he stocks **all** of your Republic Rubber Product needs.

Yes, whether you require V-Belts in individual sizes or matched sets, Rotary Drilling Hose, Vibrator Hose, Mud Pump Suction Hose, or any other Republic Rubber Oil Industry Product—call your local Republic Rubber Distributor. He has it in stock.

Stocked in the Mid-Continent Area by JONES & LAUGHLIN STEEL CORPORATION, Supply Division P.O. Drawer 2481, Tulsa 2, Okla. and the J & L Store in YOUR field.

REPUBLIC RUBBER DIVISION

LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO

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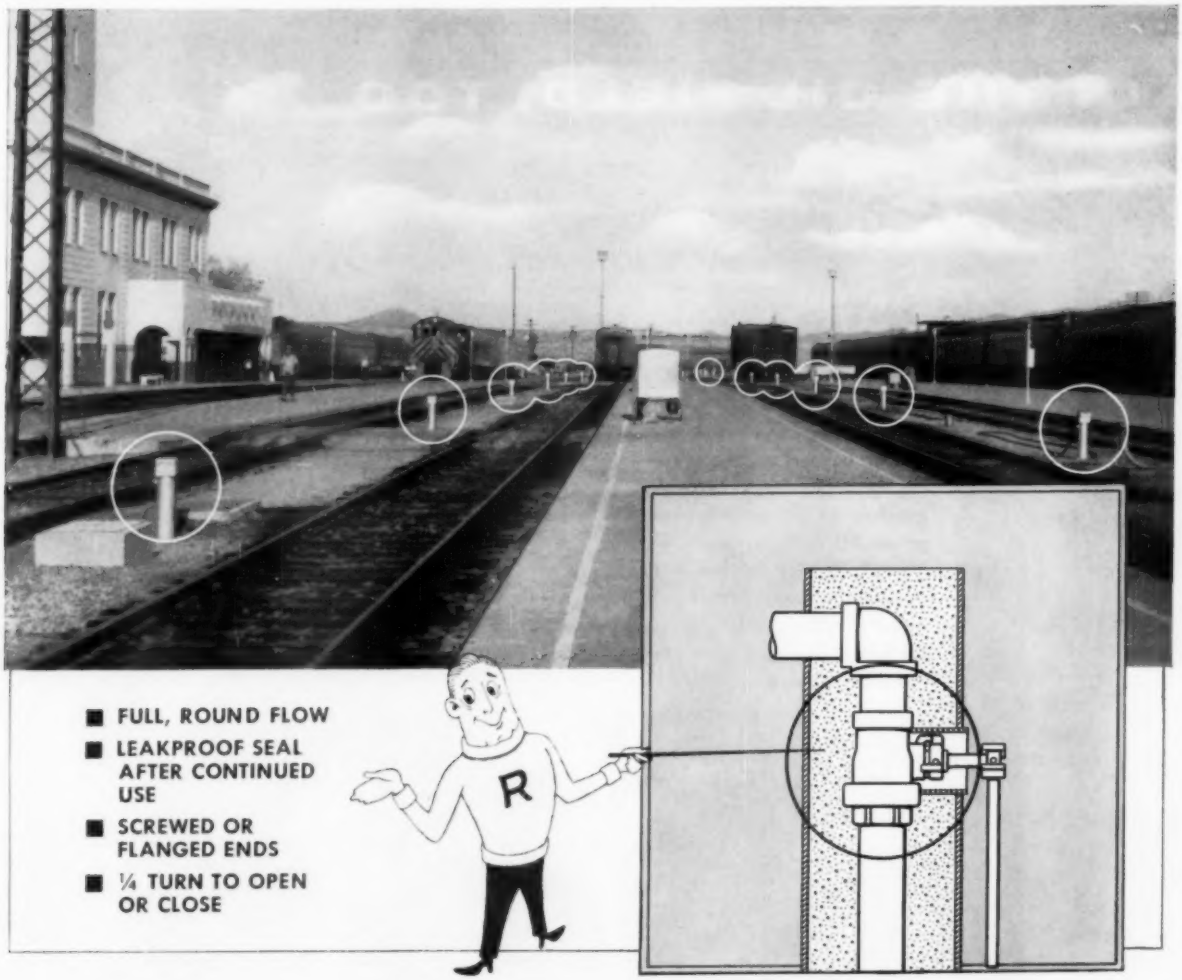
Stocked on the West Coast by HENDRIE BELTING & RUBBER CO. 405 Towne Ave., Los Angeles, Calif. PACIFIC COAST RUBBER COMPANY 51 Main St., San Francisco, Calif.



- FULL, ROUND FLOW
- LEAKPROOF SEAL AFTER CONTINUED USE
- SCREWED OR FLANGED ENDS
- ¼ TURN TO OPEN OR CLOSE

Rockwood Ball Valve

Positive Shut Off – Positively Leakproof

Rockwood's forged Ball Valves solve tough water handling problem at Southern railroad station. A quarter turn opens and closes this valve without leakage — even after continued use! The liquid pressure automatically positions ball against the synthetic rubber seat — and the retainer spring assures tight seal in case the pressure is very low. It's trouble-free, long wearing and job designed. Several seat materials available for different applications. The coupon will bring full information on how you can reduce maintenance costs by using Rockwood Ball Valves. Tested and listed by Underwriters' Laboratories, Inc. Distributors in all principal industrial areas.

ROCKWOOD BALL VALVES

FULL, ROUND FLOW

ROCKWOOD

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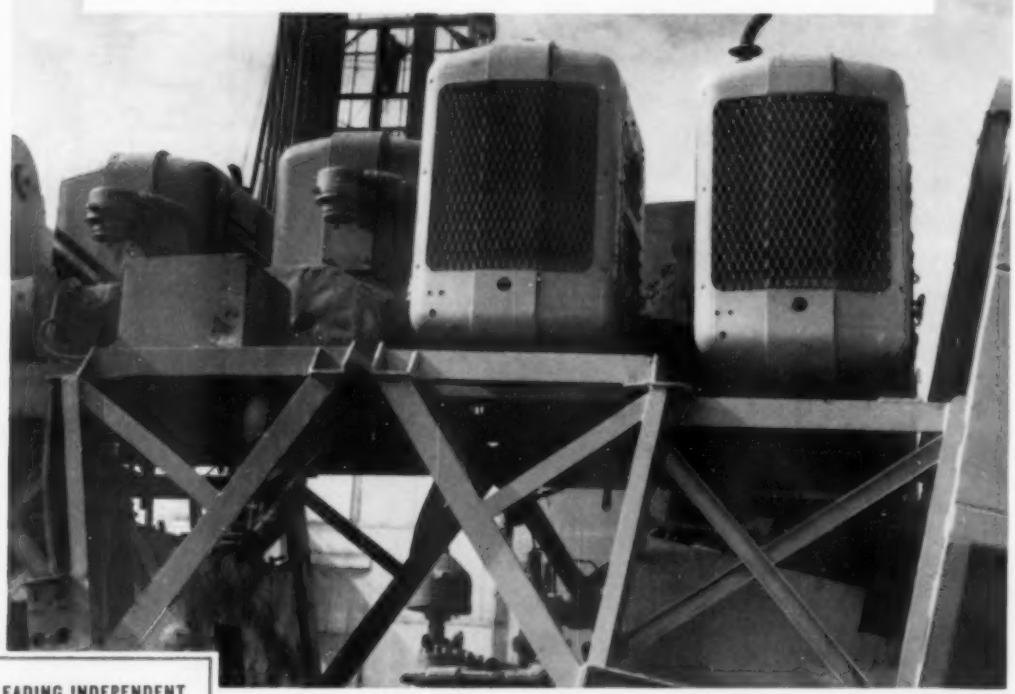
• Any oil field equipment with a power requirement within Continental's range will run longer, for less, and with least time out, on Continental Red Seal. The reason lies in specialization—in Continental's long-standing policy of engineering each model precisely to the job to be done. Each and every model is the product of 56 years' engine-building experience. The industrial series comprises 50 different basic models, with an output range from 14 to 237 horsepower. Twelve of these are Diesels with exclusive Continental Cushioned® Power. Throughout the oil fields, on all types of installations, you'll find Red Seals powering the finest equipment—and they're available for operation on all standard fuels. Visit your nearest oil field supply store or write the factory for information.



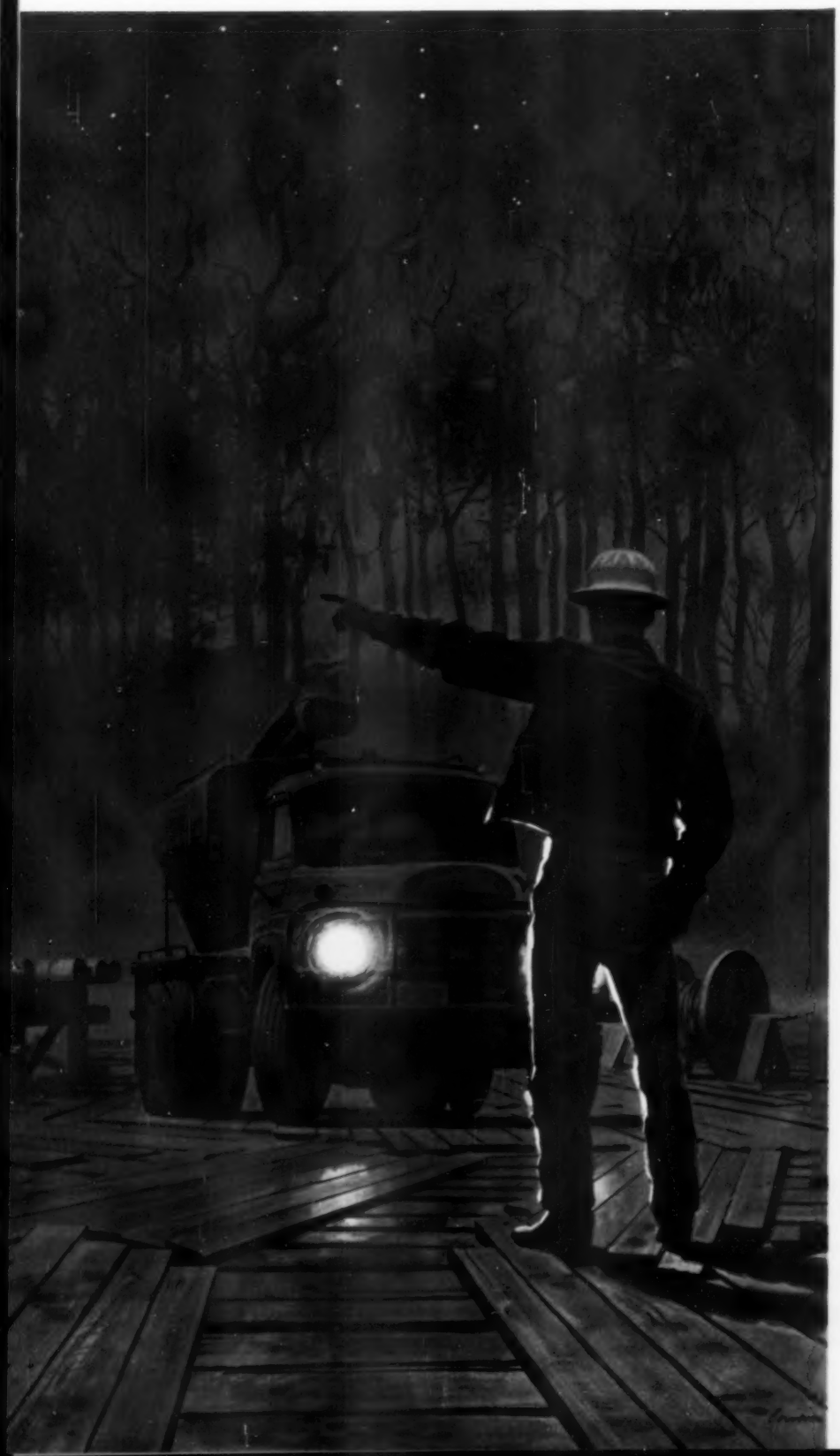
WORLD'S LEADING INDEPENDENT MANUFACTURER OF INTERNAL COMBUSTION ENGINES, CONTINENTAL MOTORS OPERATES PLANTS IN ATLANTA, DALLAS, DETROIT, MILWAUKEE, MUSKEGON, AND TOLEDO, AND IN ST. THOMAS, ONT., PRODUCING AIR-COOLED AND LIQUID-COOLED ENGINES FOR USE ON LAND, AT SEA AND IN THE AIR.

Continental Motors Corporation

MUSKEGON • MICHIGAN

FACTORY-APPROVED SERVICE AND GENUINE RED SEAL PARTS ARE AVAILABLE ALL OVER THE WORLD

With Magcobar on your well ...



you get the right products when you need them

Wherever you drill there's a Magcobar dealer close by. His job is to help make drilling your well as routine as possible. But, when the unforeseen happens, he is ready to pitch in even harder.

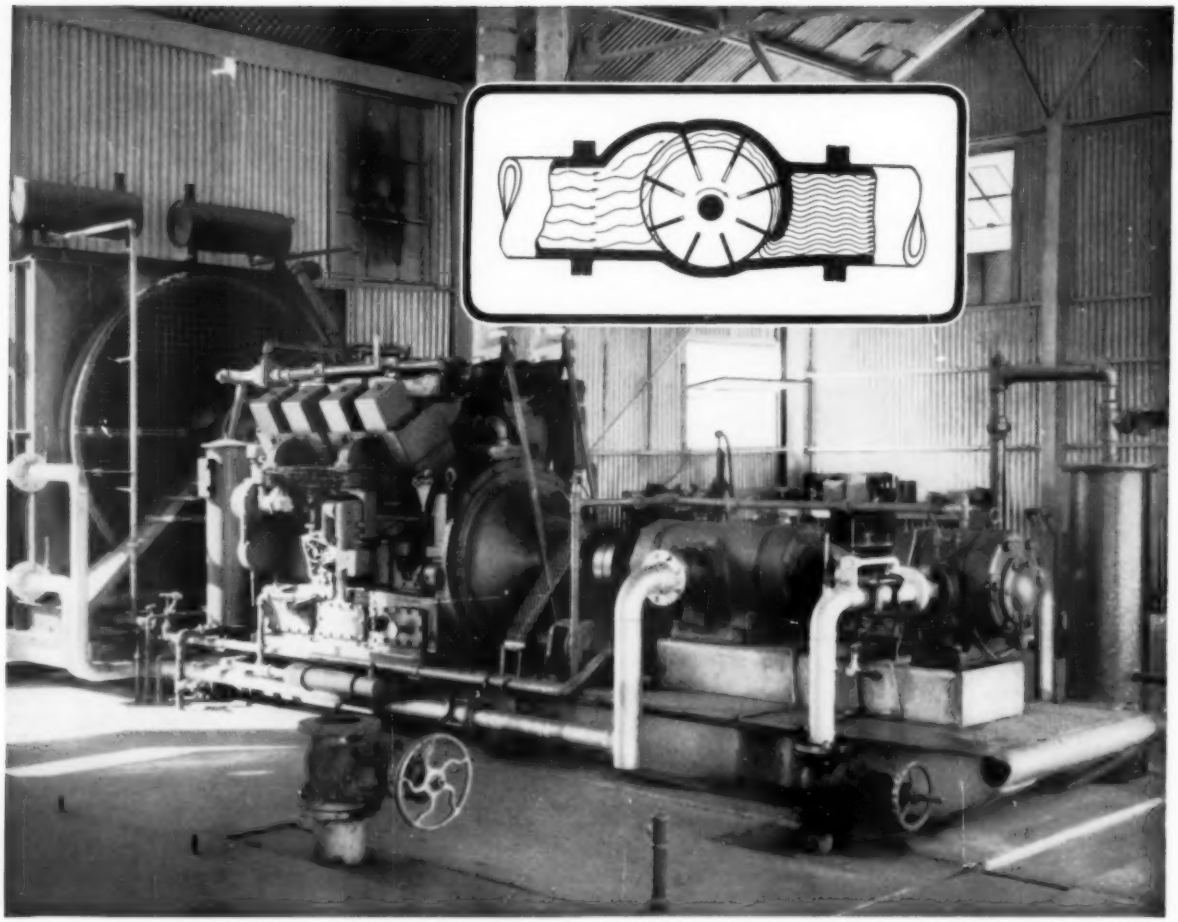
The Magcobar dealer stocks the emergency materials you might need. He has the facilities to get them to your well when you need them. To get them there fast.

This extra degree of service from the Magcobar dealer is one more reason why it pays to use Magcobar. When the Magcobar team is working for you you get the industry's best qualified mud engineers, the best drilling muds and chemicals — at your well when you need them. Be sure Magcobar is on your next well. Start planning now.

Magnet Cove Barium Corporation
Houston, Texas

Magcobar
Complete
DRILLING MUD SERVICE

58-103



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...FULLER ROTARY COMPRESSORS ARE ON THE JOB

. . . More and more, the petroleum industry is turning to Fuller for dependable, trouble-free service. Indoors or out, Fuller Rotary Compressors can withstand the most rugged use with minimum maintenance and operating costs.

There's good reason too—

There are no valves, crankshafts, crossheads or other moving parts to require constant attention, adjustment, or replacement. What's more, the blades of a Fuller Rotary are held out by centrifugal force, automatically compensating for wear and maintaining original capacity for the life of the machine.

Here, near Stinnet, Texas, is a C-100-100H Fuller Rotary Two-stage Compressor, giving day-in-day-out service boosting casing head gas from 5-lb to 115-lb. It is equipped with a radiator section for gas intercooling, a section for engine jacket water cooling, and a section for compressor jacket water cooling.

There is a Fuller Rotary Compressor to fit your particular needs. Complete details, as well as sizes available on request. Write.

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PIONEERS OF HIGH-EFFICIENCY VANE TYPE ROTARY COMPRESSORS SINCE 1930

You say you have a temperature problem?

If things are getting too hot for you, get in touch with National Tube. We *specialize* in solving temperature problems—and pressure, oxidation, acid and corrosion problems, too. As a matter of fact—as if you hadn't guessed—we make our living by solving *all* types of refinery tubing problems.

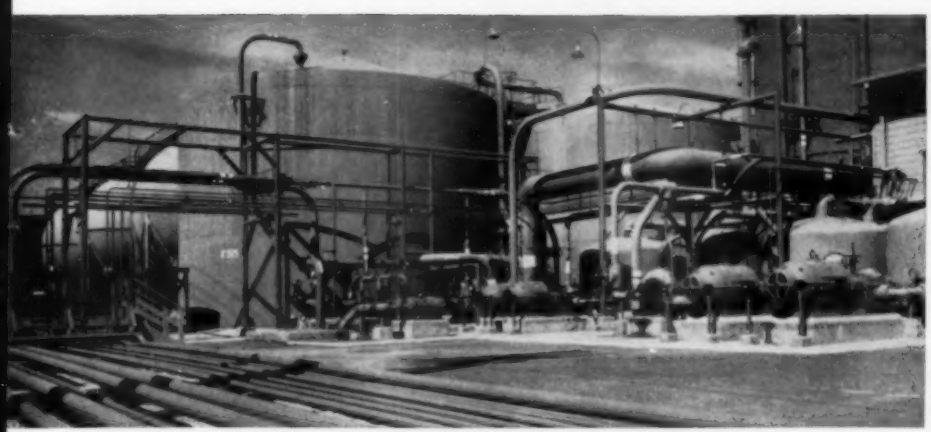
Here's how we do it: for over 60 years we have kept case histories on difficult refinery tubing problems, each of which was solved by one of our steel alloys. From this accumulation of alloy information, National Tube has developed 24 different seamless steel tube analyses, each designed to combat a specific set of refinery conditions. Every one of these analyses has been proved time and time again in actual refinery service. We feel confident that one of them is the answer to your problems.

In addition to these two dozen analyses, other chemical compositions are available in seamless tubular products, and a wide variety of temperature problems is presently under study.

Get in touch with us. Our Mill Service Force, available for field consultation, will help you find just the alloy you need, at the right price, to meet your refinery conditions. Write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

HERE ARE NATIONAL TUBE'S TWO DOZEN DIFFERENT TUBE ANALYSES:

Carbon	5 Cr, ½ Mo	17 Cr
Carbon, ½ Mo	5 Cr, ½ Mo, 1½ Si	18-8
1 Cr, ½ Mo	7 Cr, ½ Mo	18-8 Ti
1¼ Cr, ½ Mo	8 Cr, ½ Mo	18-8 Cb
2 Cr, ½ Mo	8 Cr, 1 Mo	18-8 Mo
2¼ Cr, 1 Mo	9 Cr, 1 Mo	25-20
2½ Cr, ½ Mo, ¾ Si	12 Cr	3½ Ni
3 Cr, 1 Mo	12 Cr, Al	5 Ni



The world's finest tubular products from the best-known name in pipe—*National Tube*

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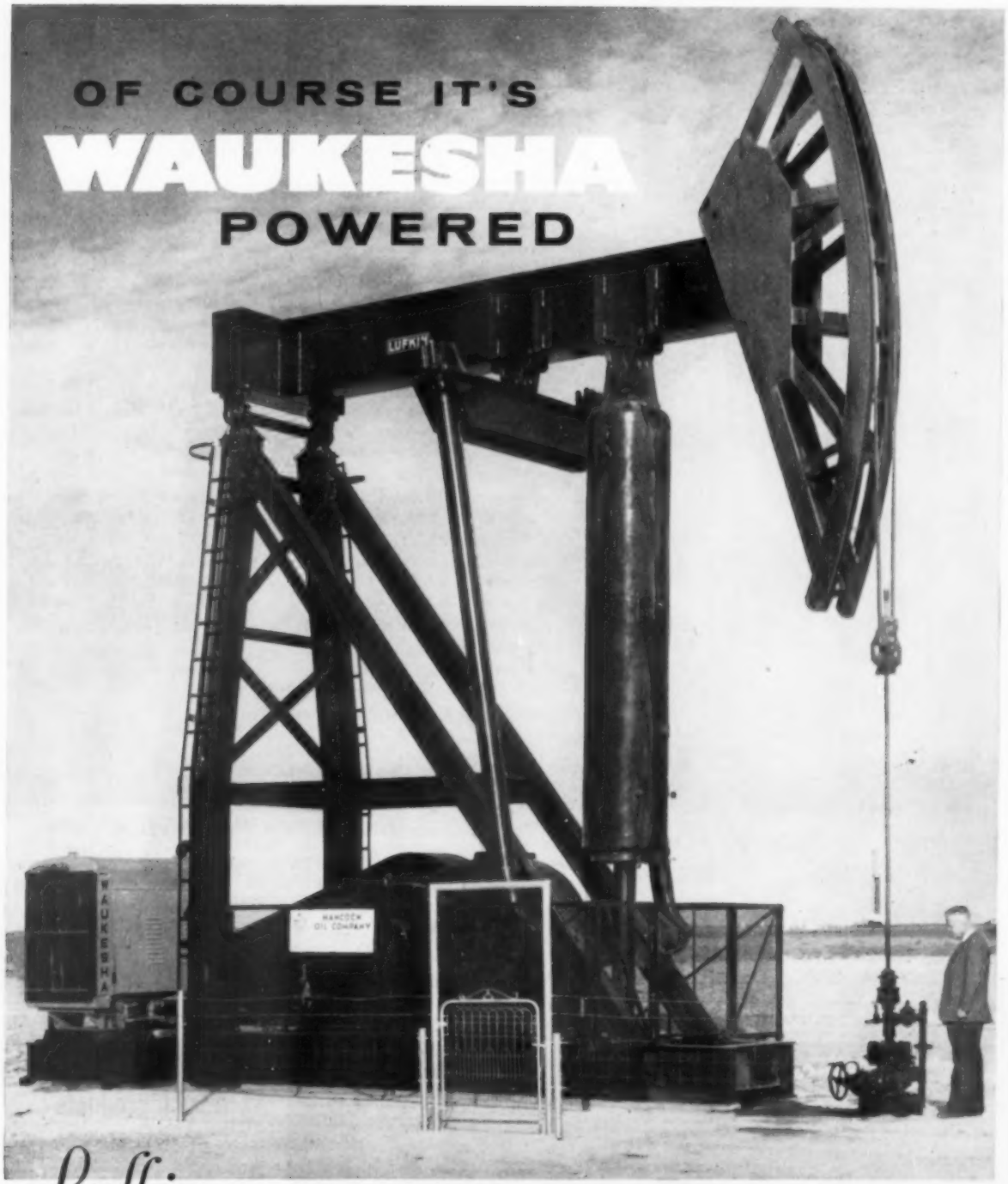

Lufkin . . . **the largest beam type pumping unit built**

Owned by the Hancock Oil Company and operating on their lease near Tatum, New Mexico—this A-1500D-192-42 air balanced Lufkin pumping unit has a 16-ft. stroke and a gear box with a capacity of 1,500,000 inch pounds. It is the largest beam type pumping unit built. It has a Waukesha Long-Life WAKU Oil Field Gas Power Unit, with an 1197 cu. in. six-cylinder engine, 6¼-in. bore x 6½-in. stroke. This is the second of these large units bought by Hancock Oil Company. That says a lot for the satisfaction-in-use of this reliable Lufkin-Waukesha combination.

Send for Waukesha Bulletins 1702 and 1079. 379

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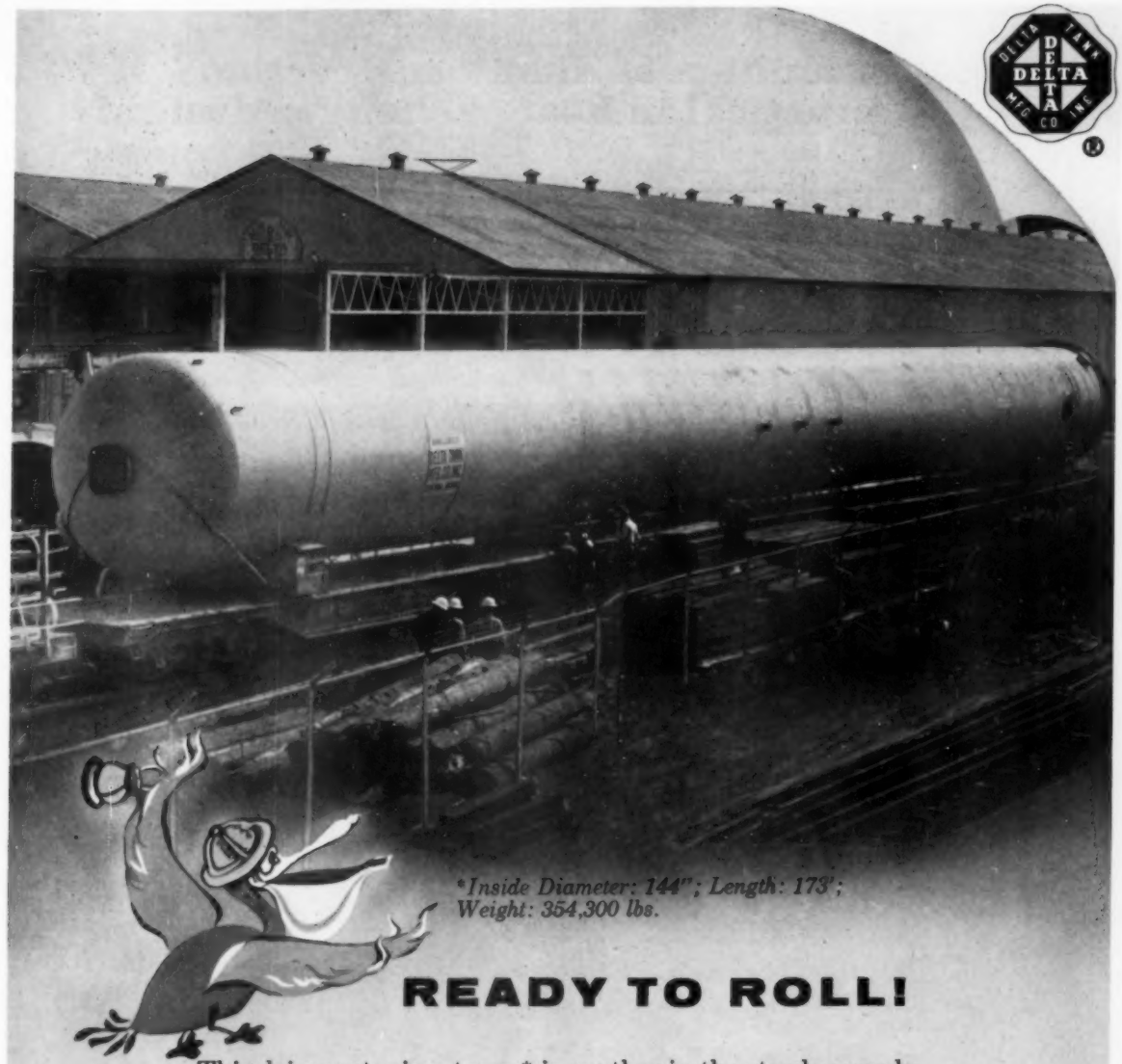

**Inside Diameter: 144"; Length: 173'; Weight: 354,300 lbs.*

READY TO ROLL!

This deisopentanizer tower* is another in the steady parade of custom-built pressure vessels delivered from Delta Tank fabrication shops to the petroleum and petro-chemical industries.

Its delivery in this completed form on the job in North Louisiana is saving money for the contractor involved, and for the ultimate customer.

Why not put this special manufacturing experience and these modern facilities at Delta Tank to work to meet your pressure vessel problems?

DELTA TANK MANUFACTURING COMPANY, INC.

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PLANTS: • BEARDSTOWN, ILL. MACON, GA.
SALES OFFICES: HOUSTON, TEXAS, • NEW YORK, N. Y.
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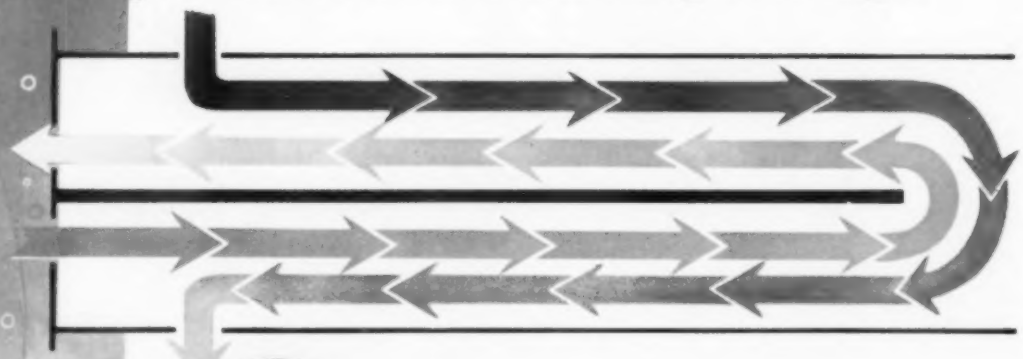
Is multi-pass shell construction practical in heat exchanger design?



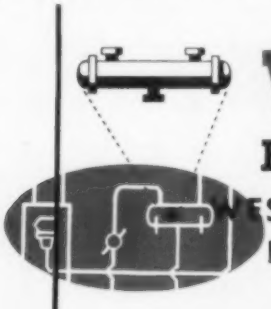
Question:
Are the design features of multi-pass shell construction sound and applicable for process heat exchangers?

Answer:
***Yes, if properly designed and applied,* multi-pass shell heat exchangers effect substantial savings in initial installation costs. Western has been successful with multi-pass shell construction because . . .**

. . . of a thorough knowledge of the applications for which each Western heat exchanger is designed. Consequently, Western two-pass shell exchangers are recommended and specified only for those applications where they are ideally suited.

Western multi-pass shell exchangers have achieved satisfactory service for our customers at far lower investment cost. By reducing the number of shells required to handle specific applications, the Western multi-pass shell exchanger does the work of two exchangers at substantially lower initial cost.

A Western representative will gladly advise you as to the possibility of applying two-pass shell construction to your next heat transfer requirements.



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HEAT EXCHANGERS
WESTERN SUPPLY COMPANY
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...it stands alone–

In this latest development we reaffirm our pledge to make a better gauge ever better. Only in the Marsh Christmas Tree Gauge you have:

—**A better tube construction**—bourdon tube and socket fused into a one piece permanently leak-proof unit by the exclusive Marsh "Conoweld" process.

—**A better movement**—all but frictionless as a result of the self-lubricating effect of unlike metals. Coined sector gear gives greater strength where greater strength is needed; also smoother operation.

—**A better case**—a copper-clad wrought steel case of boiler plate thickness, produced by the "Marsh-alloy" process. It has the strength of steel, the corrosion resistance of copper, and is one-third lighter than conventional cast-iron cases. The case is finished in corrosion-resistant satin black enamel.

—**the Marsh "Recalibrator"**—not only the handiest way to keep a gauge accurate; also the *best* way.

★ **There is a Marsh Gauge for every oil country and refinery application. Ask your supply house or write for latest bulletins.**

MARSH INSTRUMENT CO.
Sales affiliate of Jas. P. Marsh Corporation
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Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Texas
Marsh Instrument & Valve Co. (Can.) Ltd.
8407 103rd Street, Edmonton, Alberta, Canada

Mack trucks set the pace in oil-field hauling. H. J. Jeffries' fleet containing 42 Macks carries bulky oil-field equipment and heavy machinery to oil fields in the Southwest. Mr. Jeffries has found, as have many other operators, that . . .

One **MACK** *leads to another*

You can assure more dependable oil-field operations when you rely on Mack trucks to do your hauling. They have the strength and flexibility to haul heavy, cumbersome equipment over the open highway as well as overland into isolated drilling sites. Mack's Balanced Bogie with Power Divider (which applies torque only to the wheel with traction) allows Mack trucks to move the heaviest loads over rough oil-field terrain—helps assure on-time deliveries under extreme weather and road conditions.

Low-cost operation is another important reason why Mack trucks are so well-suited for oil-field service. Economy-conscious haulers have found that Mack's ability to haul maximum payloads at low operating costs, with low down time and minimum maintenance requirements, mean consistently profitable operation, day after day, month after month.

Contact your nearest Mack branch or distributor for the names of nearby Mack users to get on-the-job proof of Mack's economy and dependability—the best reasons we know why one Mack leads to another. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

MACK
first name for
TRUCKS

They Say-

Gulf rig's power swivel

Dear Sir:

Regarding your very interesting article in the April 14 issue (p. 64) covering the use of a power swivel by Gulf Oil Corp.'s offshore rigs: I feel that you have erred on one small point.

Your article states that "the sub does not actually carry the weight of the drilling string; it is merely a rotating device." This company operates a power sub of a smaller size for workover and coring jobs, and very certainly the sub does carry the weight of the drilling string.

The only way that any tool would not carry the whole weight of the drilling string would be for it to be suspended above the block, I think you will agree, a most unconventional position.

David Jacoby
Operations Superintendent
Souris Servicing Co., Ltd.
Estevan, Sask.

Asphalt research progress

Dear Sir:

Your ACS News Report (OGJ, April 21, p. 96) of up-to-the-minute researches in the petroleum industry is most timely and commendable.

Your No. 2 item, "New Asphalt Tests Needed," speaks for itself. However, allow me to add . . . that asphalt technologists first should be congratulated on delving into this complicated field of asphalt behavior and makeup and that new techniques now appear to be able to answer soon the question of "what makes asphalt tick."

In the last instance, how well the bitumen behaves over the years on the road or in other service is what counts. . . We are certainly ready to . . . discard soon many outmoded empirical tests that . . . originated when the industry was "an art" rather than an "exact science."

New correlations of service and tests on the material itself are a tremendous advance in this field, releasing many products for paving, and no doubt also for the roofing industry, that were formerly held off the market due to noncompliance with specifications.

New researches of the type reported at the ACS meetings will have a tremendous unifying effect in bringing the highway engineer into closer contact with refinery people. . .

Edwin J. Barth
Edwin J. Barth & Associates
New York

Teaching the fundamentals

Dear Sir:

In the April 21 Journal ("Journally Speaking," p. 87) you speak of the obvious answer to "educational obsolescence." Your solution to the problem, "to keep on studying after you get out of school," is something which every aggressive engineer is doing right now. But this by no means balances the lack of proper education.

In particular, many schools now realize that teaching petroleum engineering in a purely descriptive fashion does indeed provoke "education obsolescence." While to teach the fundamental principles involved prepares the student for what ever advancements may take place. This student might well be the one to make these advancements.

William J. McMahon
Graduate Student
University of Southern California
Los Angeles.

How's East Kansas oil?

Dear Sir:

I am writing in hopes that you might answer a question for me. I am writing The Oil and Gas Journal because you have such a high reputation in the oil industry . . . With the wide coverage you have . . . I'm sure you will have the information I desire or will be able to direct me to where it is available . . .

In Kansas the counties of Allen, Crawford, Greenwood, Montgomery, Neosho, and Woodson . . . have some shallow oil wells some 300 to 1,000 ft. in depth. I would like to know how good these wells are, how many barrels a day they pump. If you could help me in this matter I would appreciate it very much . . .

Ray Waldo
Correll Hotel
Mankato, Kans.

Editor's note: The oil production in these Kansas counties is extreme-

DON'T WELD on CASING!

WHY? Because field tests made on "average" oil field welding for mounting scratchers and centralizers have shown a great variation in weld quality, and damage from undercutting, hard spots, and electrolytic corrosion. Now there is no longer any need to depend entirely on welding for scratcher and centralizer installations with possible damage to valuable equipment. You can completely eliminate welding on casing, and at the same time get an economical scratcher and centralizer installation that will not interfere with normal casing running practice . . .

B and W
AUTOMATIC STOP COLLARS

Just Slide Them On and Drive Slips Flush with Casing.

Also use B and W Thread-Lock Cages and B and W Thread-Lock Cement to eliminate welding on bottom joints to prevent unscrewing as drilling continues.

ANOTHER FIRST BY THE FIRST NAME IN PRIMARY CEMENTING TOOLS

OTHER B and W PRODUCTS:
Multi-Flex Scratchers • Nu-Coil Scratchers • Rotating Scratchers, Multi-Flex and Nu-Coil Types • Automatic Stop Collars • Stabilizers • Rotator Collars • Liner Centralizers • Latch-On Centralizers.

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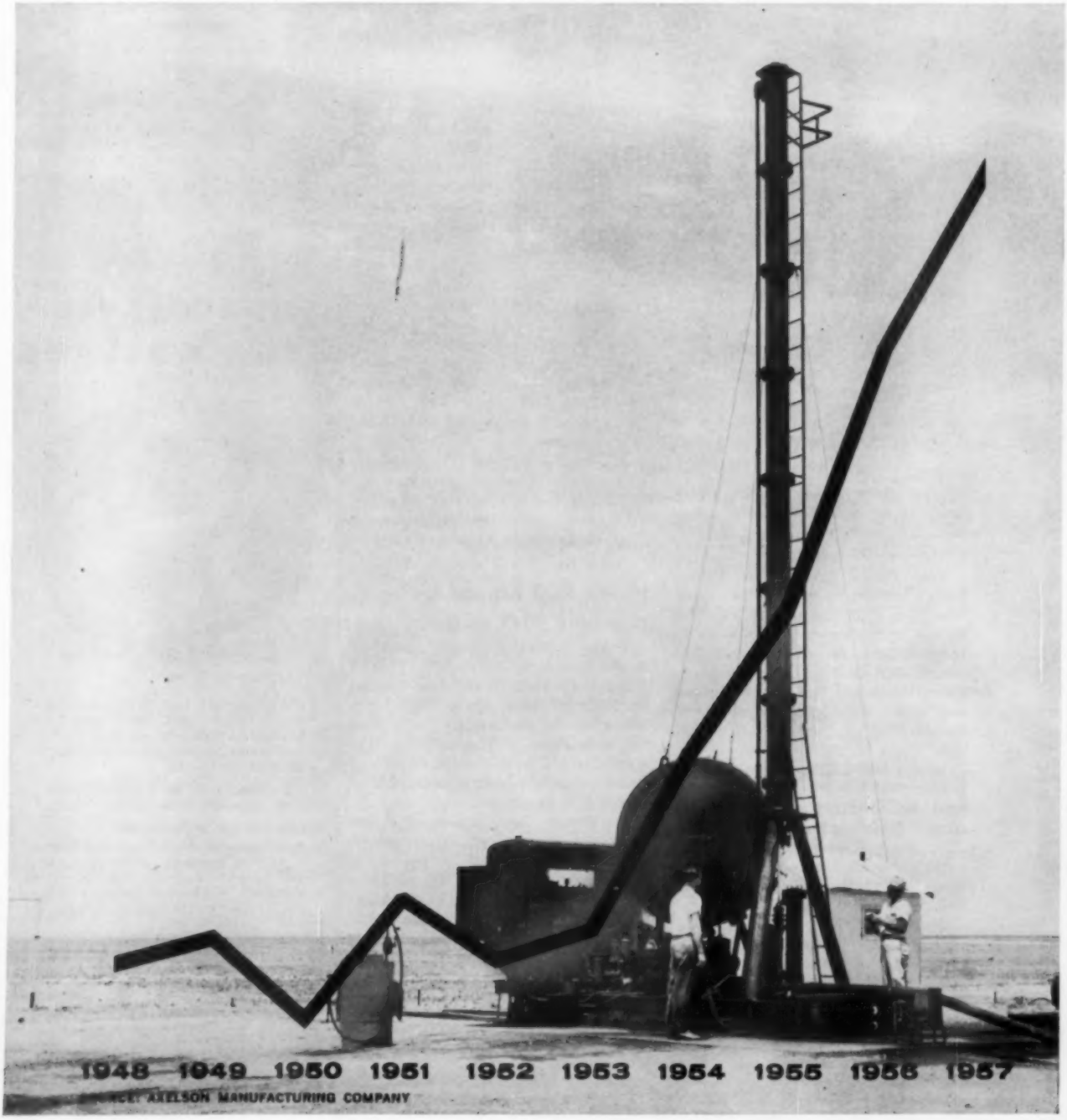
106

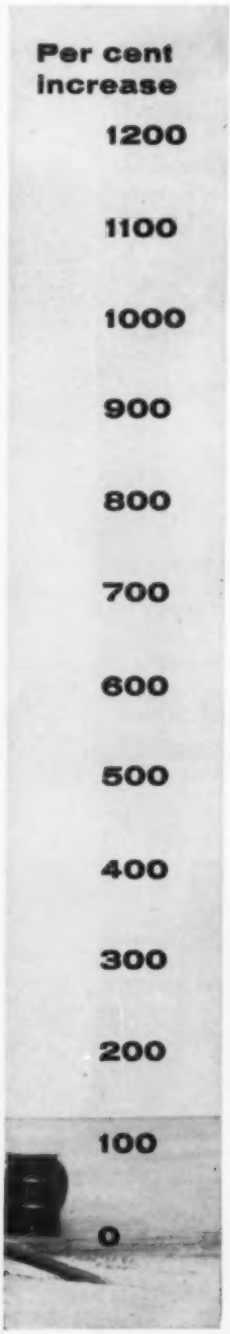
BIG GAINS FOR

Axelson Hydrax Use



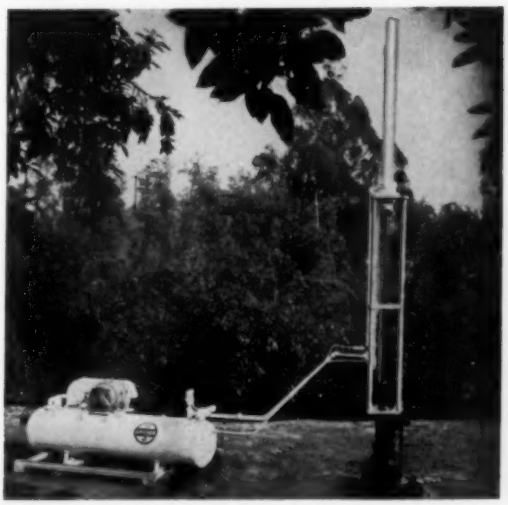
HYDRAX UNITS

Shows 10-year Record Growth



Axelson HYDRAX units have proven themselves through field use by oil companies, large and small. This acceptance is due to the many advantages offered by Axelson HYDRAX units, backed by a factory-trained service organization.

- Sucker rod life extended as much as eight times
- Rod stresses safely increased as much as 30%
- Improved volumetric efficiency
- Ease of installation
- Gas lock eliminated by high compression ratios
- Less wear and tear on subsurface pumps
- Less turbulence at well bottom



For more information concerning the complete line of HYDRAX hydraulic pumping units, write for brochure.

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There is no economical substitute for quality.

AXELSON MANUFACTURING COMPANY

Division of U. S. Industries, Inc.
6160 So. Boyle Avenue, Los Angeles 58, Calif.

Since 1898 products designed to give oil a lift

AXELSON PRODUCTS ARE DISTRIBUTED EVERYWHERE

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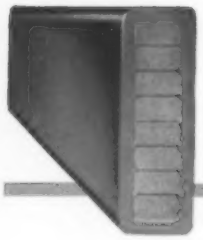
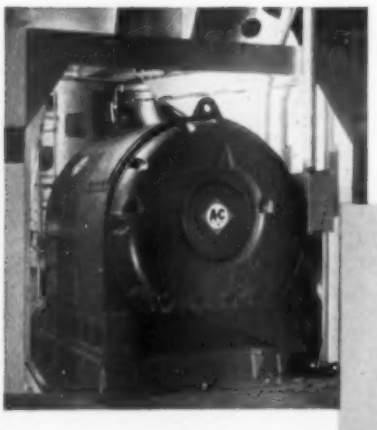


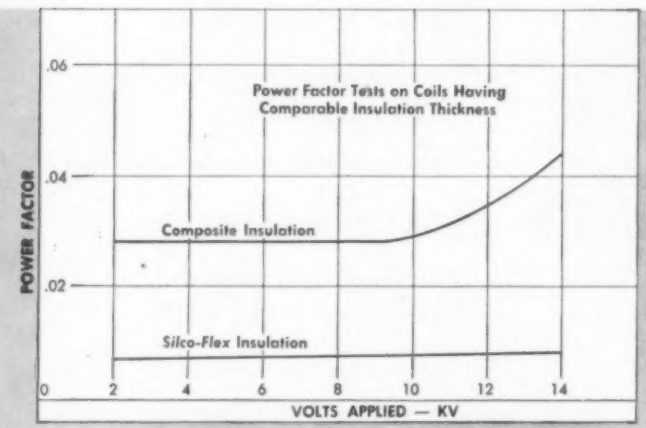
Super-Seal...

motor with void-free insulation

New motor withstands chemicals, moisture, heat, abrasion...



revolutionizes motor protection practices in chemical and petroleum industries



The void-free nature of *Silco-Flex* insulated coils is demonstrated by power factor tests on *Silco-Flex* and composite insulations. Sharp rise in power factor of composite insulation above 9 kv is result of ionization of voids.

Remarkable new insulating systems combined with advanced mechanical features provide a completely new concept in motor protection — the *Super-Seal* motor. This revolutionary new motor gives you complete protection from moisture, corrosion and contaminants, even with so-called drip-proof motor enclosures.

New motor is protected with:

Silco-Flex stator coil insulating system. A homogeneous, void-free dielectric barrier combining resilience with moisture, heat and abrasion resistance. *Silco-Flex* insulation is specially designed for most corrosive or chemical atmospheres.

Integrated field coils in synchronous machines are completely sealed against contaminants, bonded and locked against mechanical forces.

For additional information, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Note difference in abrasion! Insulation shown after sandblasting for one minute with 90-grit aluminum oxide and 100-psi air from distance of six inches.

Super-Seal and *Silco-Flex* are Allis-Chalmers trademarks

ALLIS-CHALMERS

A-5701

ly variable. Wells run from about 300 ft. to 1,000 and even 2,000 ft. in depth, and they produce from the Pennsylvanian sands on down to the Arbuckle limestone. Some of the wells are 50 years old; some are recent completions. Many of the wells are strippers and produce only ⅛ to ½ bbl. per day. In some cases, the wells are under high-pressure water flood and make 50 bbl. per day. Some new completions have been fractured or acidized and are also good producers.

Boycott a sure cure?

Dear Sir:

. . . The mining business started down the drain pipe some 25 years ago and is still going right down the same old pipe, imports being the cause. Oil, in my . . . opinion is headed right down the same old line, imports being the cause. Here might be a . . . cure for the situation:

Why not notify all foreign countries that unless they prorate their oil fields along the same pattern as our country prorates its wells that this country will not allow imports of (their) oil . . . Then, if this isn't a cure for the sick oil industry . . . the people should get together and declare a boycott against all firms importing oil . . . and not patronize them in the purchase of any product manufactured from imported oil . . . this would be one sure cure . . .

Guy J. Stumpff
Guy J. Stumpff Co.
Oil Producers and Investments
Denver.

Wage freeze in steel?

Dear Sir:

The 20-cent an hour increase in wage costs scheduled for this coming July 1 in the steel industry should be postponed until July 1 of next year.

The present wage contract scheduled to expire next year should be extended to July 1, 1960.

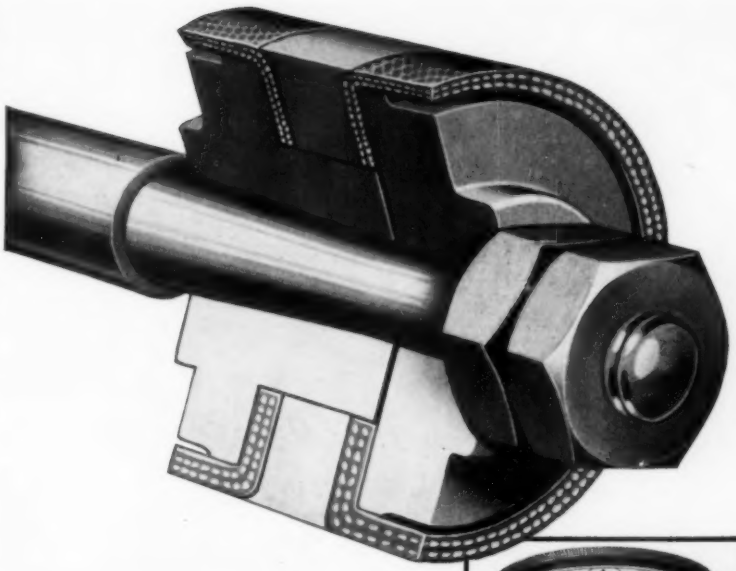
Current posted steel prices should be extended to July 1, 1960.

The present formula granting automatic wage increases as the cost of living rises should be discarded.

Joint negotiations should begin to develop a sound formula granting increases in wages as productivity rises; this to become the basis for a new wage contract in 1960. . .

A big rise in steel wages with a sharp effect on steel prices can further depress the basic steel industry, and drop our country out of a recession into a depression.

Our steel industry now has more



WHY PUMCUPS MAKE A DIFFERENCE

Darcova Pumcup

Darcova 45° Bevel Type Pumcup

- in reciprocating pumps
- in air and hydraulic cylinders

With Darcova Pumcups in your cylinders, there's less fluid slippage. High volumetric efficiency is maintained and Pumcups outlast other packings at least 3 to 1! There's less down-time! Lower power cost! Smoother operation! Less maintenance and replacement!

Longer life is the result of truly advanced cup engineering, including 100% nylon composition, plus a choice of types, textures and precision sizes to exactly match fluid, cylinder, pressure and temperature conditions.

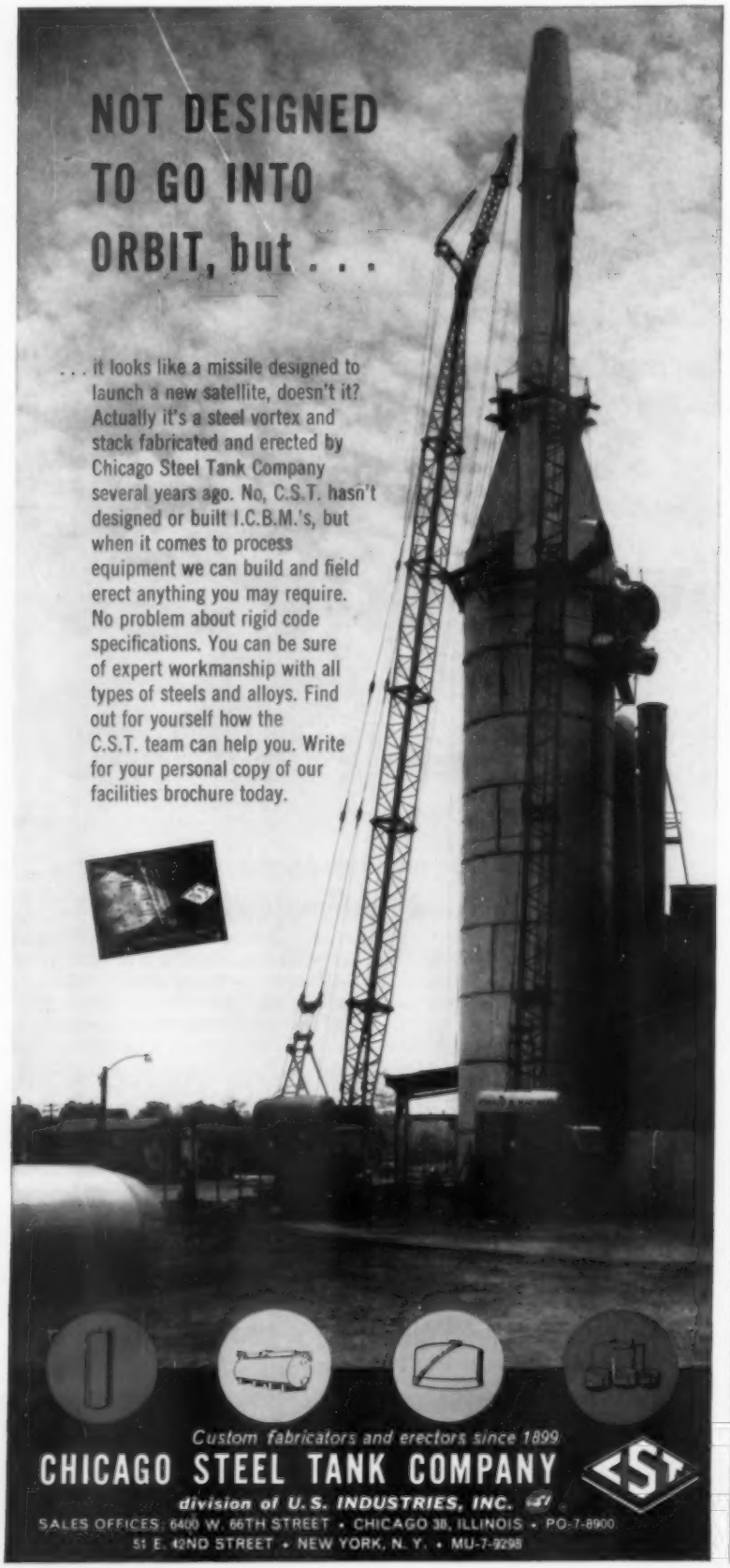
These same factors contribute to prolonged high efficiency by permitting full advantage of the "cup principle". Thus fluid pressure always keeps Pumcups snug against cylinder wall, despite eventual wear, while the total frictional load is minimized.

Send for Bulletin 5503. It will give you *all* the facts.

DARLING VALVE & MANUFACTURING CO.
Williamsport 1, Pa.

DARCOVA
THE ORIGINAL CONFOSITION CUP

TRADE MARK
PUMCUPS


NOT DESIGNED TO GO INTO ORBIT, but . . .
. . . it looks like a missile designed to launch a new satellite, doesn't it? Actually it's a steel vortex and stack fabricated and erected by Chicago Steel Tank Company several years ago. No, C.S.T. hasn't designed or built I.C.B.M.'s, but when it comes to process equipment we can build and field erect anything you may require. No problem about rigid code specifications. You can be sure of expert workmanship with all types of steels and alloys. Find out for yourself how the C.S.T. team can help you. Write for your personal copy of our facilities brochure today.
Custom fabricators and erectors since 1899
CHICAGO STEEL TANK COMPANY
division of U.S. INDUSTRIES, INC.
SALES OFFICES: 6400 W. 66TH STREET • CHICAGO 38, ILLINOIS • PO-7-8900
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idle steel capacity—70 million tons—than the total steel-making capacity of Russia. What is worse, the Russians will produce close to 65 million tons of steel this year and it is now very doubtful if total U.S.A. steel output will be as high in 1958.

We have got to adopt a stable wage-price structure in steel to get out of this depression, as we cannot afford to let the Russians outproduce our steel industry in 1958 for the first time in history.

Harold J. Ruttenberg, president, Stardrill-Keystone Co., Beaver Falls, Pa., in a letter to David J. McDonald, president of United Steelworkers of America, and Roger Blough, chairman of the board of United States Steel Corp.

CALENDAR

MAY

20-22 Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa.

21-22 Western Petroleum Refiners Association, Southwest regional technical-industrial relations meeting, Hotel Paso del Norte, El Paso, Tex.

21-23 Rocky Mountain Oil and Gas Association, thirteenth annual convention, Cosmopolitan Hotel, Denver.

21-23 American Petroleum Institute, Division of Marketing, midyear meeting, Roosevelt Hotel, New Orleans.

21-23 Instrument Society of America, national power instrumentation conference, New York City.

22-23 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

26-28 Chemical Institute of Canada, annual conference and exhibition, Royal York Hotel, Toronto.

27-29 Annual Short Course in Gas Technology, Texas College of Arts and Industries, Kingsville, Tex.

28-29 Rocky Mountain Oil and Gas Association, refining committee annual meeting, Cody, Wyo.

JUNE

2-4 University of Texas, short course and conference on automation and computers, University of Texas campus, Austin.

2-4 Petroleum Electric Power Association annual meeting Texas Hotel, Fort Worth.

4-6 National Association of Corrosion Engineers, Southwestern Louisiana Institute, second annual corrosion short course, Lafayette, La.

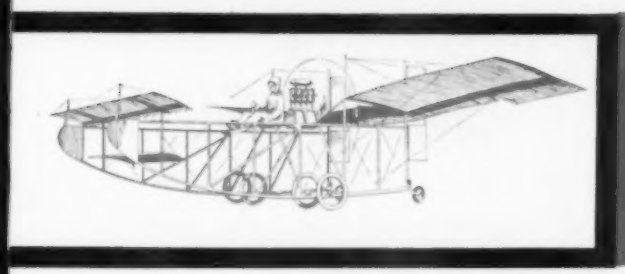
5-7 National Oil Scouts and Landmen's Association, annual meeting, Mayo Hotel, Tulsa.

8-11 American Petroleum Institute, Division of Transportation, annual tanker conference, Greenbrier Hotel, White Sulphur Springs, W. Va.

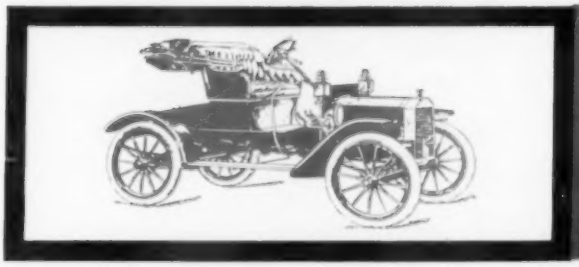
8-13 Society of Automotive Engineers, summer meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

10-12 Appalachian Underground Corrosion Short Course, School of Mines, West Virginia University, Morgantown, W. Va.

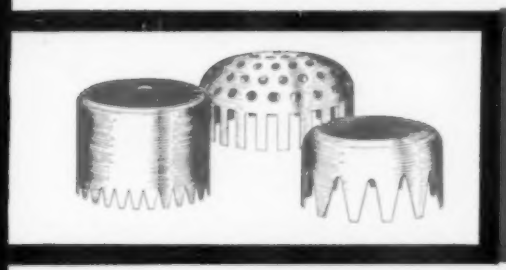
there's been

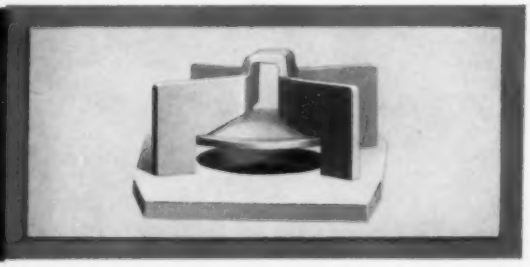


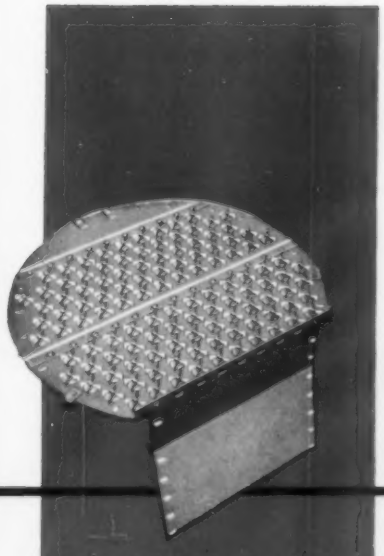
some changes made



in fractionating trays, too!







Today's trend in progress is away from "horse-and-buggy" bubble trays to Koch's jet-age **FLEXITRAY** . . . and, for good reason!

With "Flexitray," the entire tray area is available for vapor-liquid breakout . . . no obstruction to liquid flow exists . . . vapor separates at lower velocities. "Flexitrays" remain cleaner – longer!

With its extreme flexibility and capacities, it is small wonder that major companies – looking for the best designed trays – have adopted "Flexitray" for more than 700 **NON-CAPTIVE** installations.

Write . . . wire . . . phone your nearest Koch representative or:

KOCH ENGINEERING COMPANY, INC.

DESIGNERS AND FABRICATORS OF MODERN TRAYS

321 WEST DOUGLAS AVENUE, WICHITA 2, KANSAS

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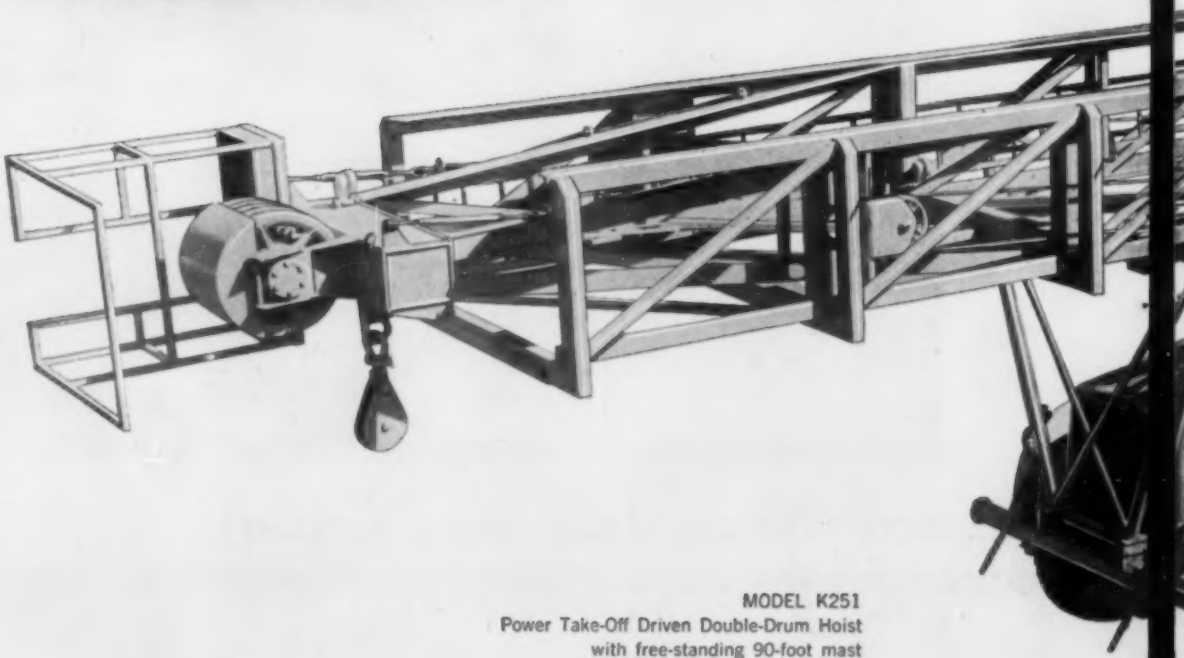
cardwell *Introduces*



MODEL K251
Power Take-Off Driven Double-Drum Hoist
with free-standing 90-foot mast
170,000-lb. hook load capacity

This outstanding, modern unit meets today's requirements for deep well servicing and workover. The rotary drive, while optional, was engineered as an integral part of the unit. The 90-foot, 170,000-lb. structural mast is designed to rack tubing in doubles and to hang rods in triples. Various heights of single- or double-leg pipe mast are also applicable.

A wide range of truck makes and models will accommodate this Cardwell unit. All controls, including transmission shift, are located at operator's position for efficiency and safety. Recommended depth rating is 15,000 feet with 2½-inch tubing. Unit can utilize up to 350 truck engine horsepower.

available as separate-engine powered double-drum hoist

Cardwell Model K250 is powered by a separate engine, up to 350 H. P. class. It features the same rugged characteristics of Model K251, and can be mounted on a trailer or drive-in type carrier. Ask your nearest Cardwell Representative for full details.

a rugged 15,000-ft. servicing unit

compare these features!

***LARGE DIAMETER HIGH-CAPACITY BRAKES**

Big 44" x 9½" brake flanges provide long life and low maintenance for both flanges and blocks. Cardwell's time-proven brake linkage system provides safe, easy load control for all operations.

***OUTBOARD-MOUNTED DRUM CLUTCHES**

Clutches are the latest improved type available. Fawick Ventilated Construction dissipates heat from frequent engagement and assures minimum maintenance and downtime.

***DOUBLE-END DRUM DRIVE**

Two drum clutches mounted on shaft ends provide 10 forward and 2 reverse speeds to the main drum.

***OIL BATH LUBRICATION**

All chain drives are fully enclosed and oil-bath lubricated for long life and low maintenance.

***15-INCH HYDROMATIC BRAKE**

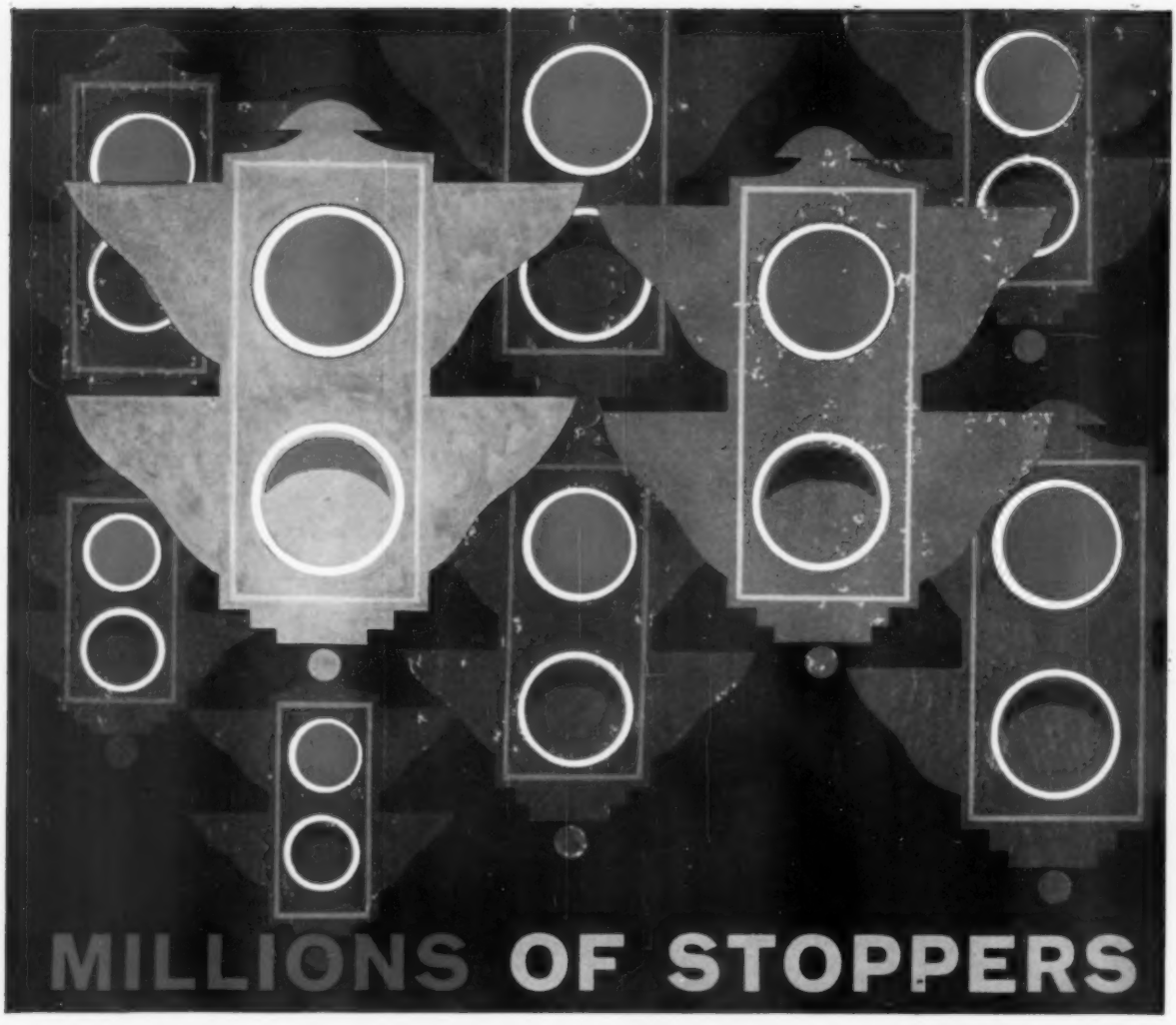
An optional hydromatic brake is of the double-rotor type for maximum capacity, with friction engaging clutch for fast, smooth operation.

Throughout the world — wherever oil is found — you'll find a Cardwell Man close by!

cardwell MANUFACTURING COMPANY

For full information call a Cardwell Representative or contact:

CARDWELL MANUFACTURING COMPANY • Box 2001 • Wichita, Kansas, U. S. A. • Cable: ALLSTEEL • Phone: AMherst 7-3311



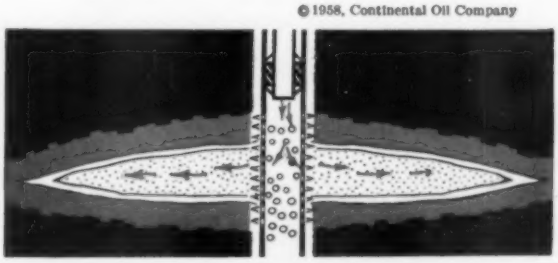
against fluid loss . . . thousands of feet below!

Millions of Adomite particles dispersed in a fracturing fluid act like traffic lights. They control fluid loss . . . stopping it by forming a temporary seal over pores of the rock matrix.

This allows a fracturing fluid to be injected at higher rates under greater pressures for an extended, deeper fracture . . . with minimum sanding out. After an Adomite treatment there is no evidence that the formation has ever been sealed. Consider these other important reasons why more producers are *standardizing on Adomite:*

- Obtains larger fractures per volume of treatment, or the same-sized fracture with a lesser volume of fracturing oil.
- Decreases friction loss because of the low viscosity of Adomite-treated fluids.
- Saves transportation costs — because Adomite permits you to use your own crudes.
- Assures acceptance by the pipe line companies for Adomite-treated lease crudes.

© 1958, Continental Oil Company



For greater profits
. . . fracture with

ADOMITE®

15-19 American Society of Mechanical Engineers, semiannual meeting, Hotel Statler, Detroit.

19 Pennsylvania Grade Crude Oil Association, annual meeting, Penhills Club, Bradford, Pa.

22-27 American Society for Testing Materials, annual meeting and exhibit, Hotels Statler and Sheraton-Plaza, Boston.

23-25 Interstate Oil Compact Commission, midyear meeting, Hotel Utah, Salt Lake City.

25-26 Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Broadview Hotel, Wichita.

24-27 Canadian Gas Association, fifty-first annual meeting, Manoir Richelieu, Quebec.

28-July 2 Petroleum Equipment Suppliers Association, twenty-third annual meeting, Chateau Frontenac, Quebec.

JULY

23-26 Wyoming Geological Society, thirteenth annual field conference, Powder River basin.

AUGUST

11-14 Society of Automotive Engineers, National West Coast meeting, The Ambassador, Los Angeles.

25-27 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

SEPTEMBER

10-12 National Petroleum Association, fifty-sixth annual meeting, Traymore Hotel, Atlantic City, N. J.

10-13 Intermountain Association of Petroleum Geologists, ninth annual field conference, Paradox basin.

15-16 Independent Natural Gas Association of America, annual membership meeting, Roosevelt Hotel, New Orleans.

18 Natural Gasoline Association of America, Rocky Mountain regional meeting, Gladstone Hotel, Casper, Wyo.

21-24 American Society of Mechanical Engineers, petroleum division, mechanical engineering conference, Cosmopolitan Hotel, Denver.

24-25 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

29-Oct. 3 Society of Automotive Engineers, national aeronautic meeting, aeronautic production forum, and aircraft engineering display, The Ambassador, Los Angeles.

OCTOBER

1-2 Western Petroleum Refiners Association, third annual stream-pollution and waste-disposal conference, Lassen Hotel, Wichita.

1-3 American Association of Oilwell Drilling Contractors, eighteenth annual meeting, Adolphus and Baker Hotels, Dallas.

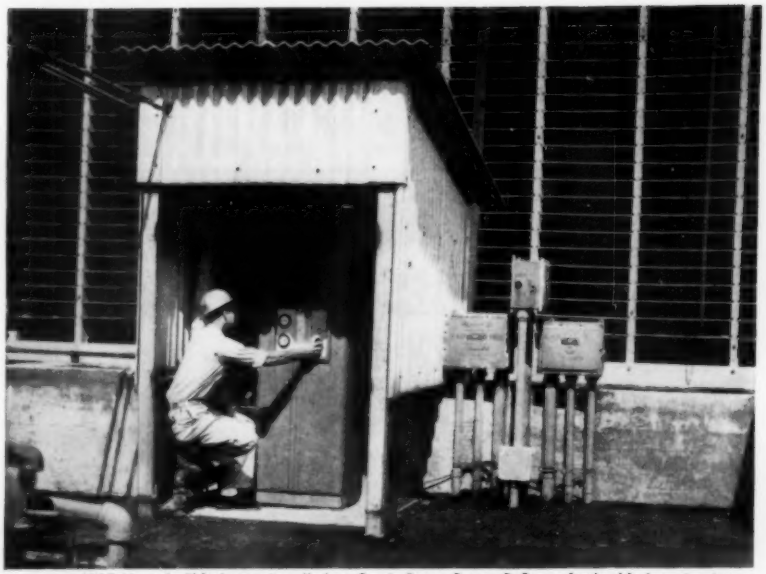
5-8 Society of Petroleum Engineers of AIME, fall meeting, Houston.

5-8 National Association of Corrosion Engineers, northeast region, Somerset Hotel, Boston.

7-8 Texas Mid-Continent Oil and Gas Association, annual meeting, Statler-Hilton Hotel, Dallas.

12-18 OIL PROGRESS WEEK.

13-15 American Gas Association, annual convention, Atlantic City, N. J.



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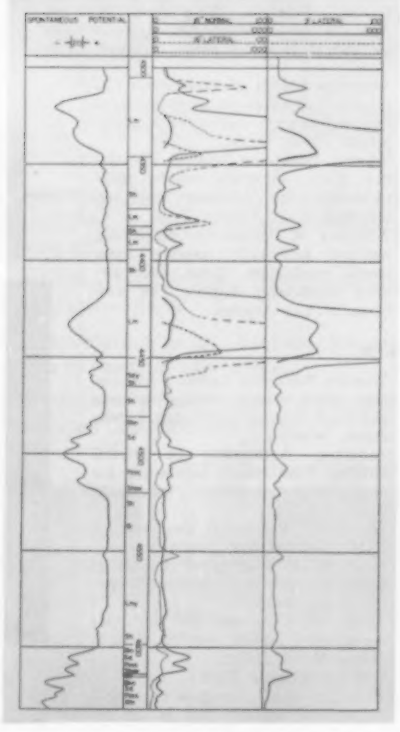

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JOURNALLY SPEAKING

Where the Market Went

ACCORDING to a TV commercial, people who brush their teeth with the sponsor's product wonder where the yellow went. That problem is nothing to the puzzlement of oil men who wonder where the market went.

"How come demand for oil is down?" everybody is asking.

There are a lot of theories and a lot of suspects, but so far the goods haven't been pinned on any culprit.

There's one theory that television is responsible. This is logical, because TV is being blamed for everything from the breakdown of our educational system to the rise of juvenile delinquency and the decline of home cooking. This theory is that nowadays people stay home and watch this electronic monster instead of cranking up the family car and visiting Aunt Jenny or going to the movies.

Another school of thought holds air conditioning to be the villain. The line of reasoning is that people just stay home and sit under the window unit all summer, whereas they used to burn up lots of gasoline just riding around trying to cool off on hot summer nights.

Other people put the blame of those little foreign cars (durned imports again) which will go from here to there and back again on a cupful of gas.

But we heard a new one the other day. This fellow insisted the trouble stems from the fact that these days most every family has two cars. When there was only one car in a family, he said, and the old man wanted to go one place and the old lady wanted to go someplace else and the kids had to be taken to still another, why that car was on the go all the time, cross-hauling and backtracking all over town and burning up barrels and barrels of gasoline. But when everybody in the family has his own car, he (or she) drives directly to where he is going, parks until he gets through, and then drives straight home. Result: Less gas used.

This is a truly alarming hypothesis. For if it's true, then the more cars we get in this country the less gasoline will be used. And at the rate Detroit can turn out cars these days, pretty soon there won't be any market for gasoline at all. If that doesn't make sense to you, don't ask us to explain. That's what the man said.

While we're wondering where the gasoline market went, along comes the National Geographic Society with an explanation of where the heating-oil market went: The winters are warmer than they used to be.

"Over the last 40 or 50 years the earth has been getting warmer," it says. "The change is gradual and there have been short-term reverses, but science has proved grandfather correct: Today's winters are not as cold as those he knew as a boy.

"At Point Barrow, the northernmost part of Alaska, the ice went out earlier in 1957 than ever before. The life of the Greenland Eskimo has been revolutionized. When seals were plentiful, the Eskimos were self-sufficient. Seals provided meat, skins for clothing and shelter, and oil for lamps.

"When warmer weather drove the seals north, the economy was wrecked. But codfish moved north, too, and became plentiful near Greenland. The Eskimo turned to fishing, which offered income but not all the uses of seals. They were forced to convert to a money-based economy.

"Climatologists differ on the cause of the warming. Some see the change as a part of the Ice Age cycle, with the ice retreating as it has several times before. Other theories tie the change to sunspot cycles, or an increase in carbon dioxide in the air caused by man's burning of fuels.

"Will the trend continue?" Again there is dispute. Some scientists forecast a century of warmer weather. Others, noting increases in the size of certain glaciers, believe the cycle may have reached its warmest point and is about to reverse itself."

Never mind those foreign cars. Keep your eyes on the Eskimos and the glaciers.

—Henry D. Ralph.

at CITIES SERVICE

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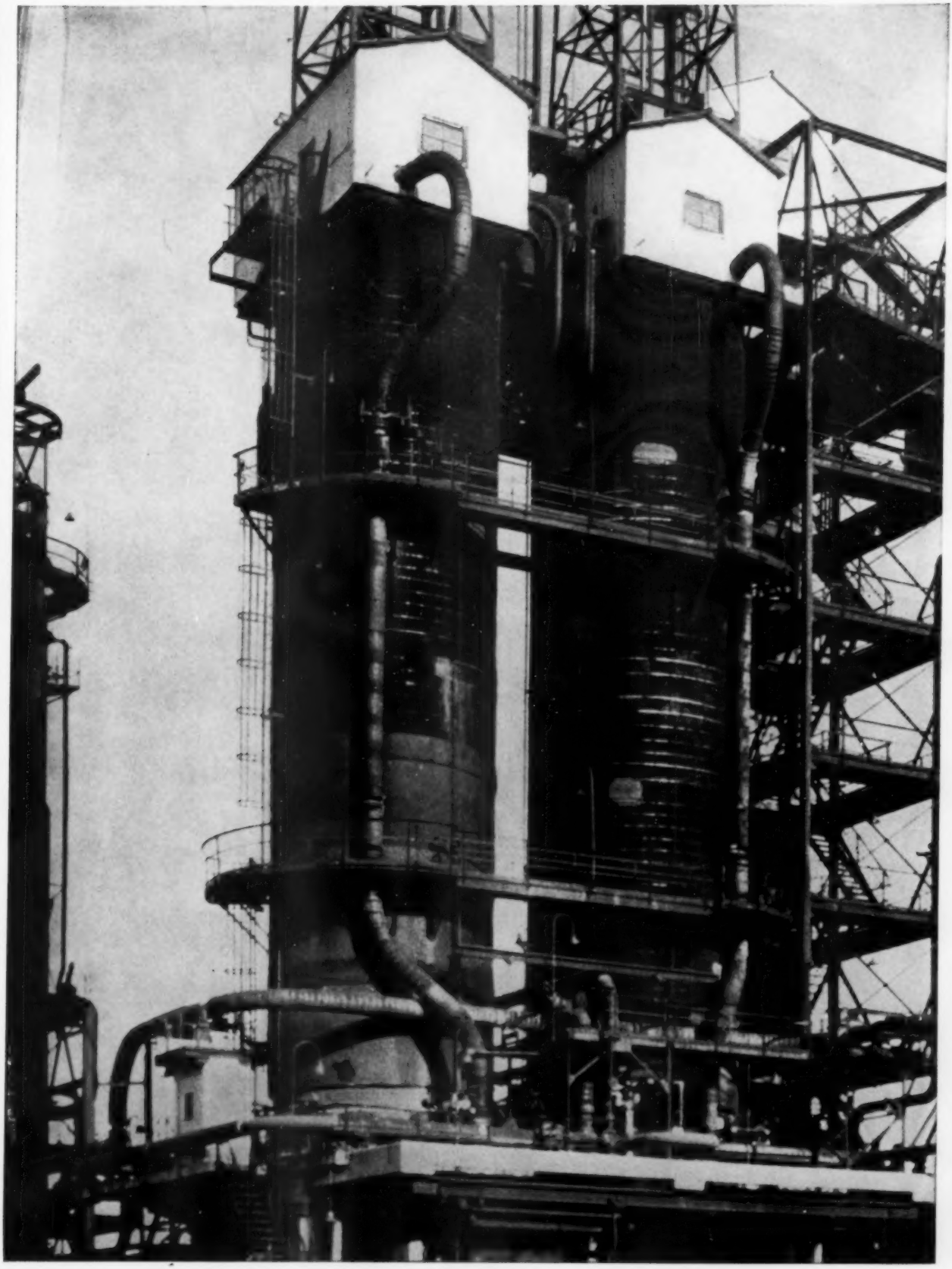

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Shale-oil taxes pose a problem for crude

SOME thoughtful people in the oil industry are disturbed over the proposal pending in Congress to give shale oil the same depletion-tax treatment as crude oil.

The concern is not over the potential threat of competition from a new source of fuel. The infant shale-oil industry should be encouraged and fostered by every legitimate means.

The worry is that the basis for the crude-oil depletion rate may be undermined if extended to shale. Then critics of the whole depletion schedule would have a better case for lowering all the rates.

THE REASON FOR DEPLETION is to permit the owner of a wasting asset, namely extraction of minerals, to recover his capital—though paying taxes on the income from it. This is to encourage him to reinvest his capital in finding new deposits.

Different rates of depletion are allowed different minerals. The scale roughly approximates the difficulties and risks involved in finding new deposits to maintain the nation's reserves.

Thus sand and gravel are given 5% depletion, coal 10%, oil shale and metal mines 15%, sulfur and uranium 23%, and oil and gas 27½%.

With these differentials already in the law, it can be argued that shale is probably in about the right place where it is. Shale deposits can be located from outcrops and outlined by core drilling. In fact, shale may be easier to find than most metallic ore bodies.

Contrast this with the increasing cost and difficulty of finding a new oil field. Crude producers insist that even the untaxed 27½% of gross income does not give them enough capital to maintain their reserves and producing capacity.

Now if shale-oil producers are given a depletion rate of 27½%, metal producers may ask for it too. And if there is any general move to revise the law, a tax-hungry Congress might very well chop down the rates for all mineral industries and abandon the present differentials based on the difficulties of finding new reserves.

PRODUCTS OF SHALE OIL, when they reach the market commercially, will be indistinguishable from products of crude oil. So it is argued that shale producers should have the same tax treatment as crude producers. This sounds plausible, but it ignores the principle of the depletion provisions.

To speed the needed development of a shale-oil industry perhaps some more appropriate form of aid can be devised—one that won't jeopardize the depletion scale for encouraging the continued discovery of liquid fuel reserves.

OIL EXPERTS* from abroad lay their cards on the table as . . .

TIPRO Hears Other Side on Imports

A FOREIGN TRADE panel of spokesmen from Europe, Canada, and Venezuela has conflicting suggestions to Texas oil men for dealing with the oil-imports problem.

Appearance of the foreign representatives was an outstanding feature of last week's TIPRO session. Panelists were B. N. Darbyshire, a British consulting economist now living in Geneva, Switzerland; J. A. Cogan, vice president of Imperial Oil, Ltd., Toronto; and Dr. Eduardo A. Acosta, minister counselor for petroleum affairs of the Venezuelan Embassy, Washington.

A tariff surprise . . . Darbyshire surprised the Texas producers by advocating the U. S. impose a tariff on foreign imports.

He suggested a levy of $1 or $1.25 per barrel, explaining this would have the effect of reducing the price of Middle East oil in Europe by almost an equivalent amount.

In the first place, Darbyshire said, this would maintain a strong U. S. industry with reserves that the free world could draw on in emergency.

His main reason, however, was to break up what he called the artificial pricing policy of Middle East producers.

Darbyshire declared that "in order to justify the high level of Middle East crude-oil prices the companies operating there have utilized the argument that these prices are established by economic forces involving competition with Texas oil when both are landed on the U. S. coast.

"The difference between Texas prices on the Texas fields and Middle East prices on the Middle East fields being a result of overcoming the necessarily greater cost of transporting crude all the way from the Middle East to the U. S. East Coast and surmounting the present small import tariff."

Darbyshire said that this argument would force Middle East producers to lower their European prices by the amount of any increase in U. S. tariff or else they would stand guilty of a price conspiracy. He said production costs are so low in the Middle East that producers could easily afford to reduce European prices by $1 per barrel or more. This would greatly expand the market for oil in Europe and reduce the need for Europe's dollar expenditures in purchasing oil.

In discussion following his paper, Darbyshire said that a quota limitation on imports would not bring down European prices. He admitted that a tariff would injure Canadian and Venezuelan exporters.

The Canadian view . . . Cogan made a plea for special treatment of Canadian imports into the U. S.

He reminded the Texas producers that Alberta currently also is prorated to an average of 8 producing days a month with major fields down to 5 days.

He said Canada is not seeking any great increase of oil shipments to the U. S. He suggested a plan which he said would not conflict with the

*PICTURED are Darbyshire, Cogan, Panel-Moderator Watson W. Wise of Tyler, Acosta, and Fred W. Shield who presided at the TIPRO session.

American most-favored-nation principle:

. . . **Receive nominations** first from those wishing to import oil by pipeline from countries of origin or from countries which are not net exporters of petroleum.

. . . **Subtract these volumes** from the total desired level of imports to determine the remaining quotas available.

Cogan gave four reasons to support this request:

1. **From the standpoint of national security,** Canadian oil, particularly when imported by pipeline, is strategically as secure as domestic crude.

2. **Canadian oil** is not likely to have sharply adverse effects on the economic health of the U. S. oil industry because its geology is similar and it is produced by scores of independents.

3. **Canada needs more exports** to maintain its trade balance with the U. S. and should be permitted to earn its own way in expanding foreign trade.

4. **Canada is entitled to some recognition** as a comparative newcomer among oil-producing nations.

Venezuela pinched . . . Acosta pleaded for continued U. S. purchase of Venezuelan oil.

He declared Venezuela needs to sell its principal export product for dollars in order to continue the high level of purchasing American goods for its economic development.

Acosta reminded his audience of the long friendship between the two countries and of the strategic value to the United States of maintaining a strong oil industry and expanding reserves in Venezuela.

Problems of regulating the volume of Venezuelan oil entering the U. S. should be solved by a trade agreement based on business principles and fair dealing, Acosta declared. He did not specify what sort of an agreement his country might be willing to enter.

Acosta also branded as unfair the tendency of U. S. domestic producers to blame oil imports for all their production cutbacks. He said there are other factors involved also.

He listed two of the factors as:

. . . **Inroads of natural gas** and natural-gas liquids. Oil consumption on an energy basis has leveled off but natural gas consumption has been climbing steadily on a steep angle and has been making inroads into oil markets. Acosta said this trend is true over the world.

. . . **Current business recession.** This has slowed down activity in many commercial areas but is a temporary ailment.

TIPRO Backs Ikard

. . . with unanimous endorsement of his imports bill, despite a strong defense of the voluntary plan by Capt. Carson.

CAPT. M. V. CARSON last week failed to sway Texas independents from their goal of imports control by legislation.

The head of the Office of Oil and Gas made a vigorous defense of the voluntary program to control imports. He warned that a more rigid system would lead to government regulation of the oil industry.

But the association voted unanimously to support the pending Ikard bill, which would limit imports of both crude and products to the 1954 ratio of domestic production and would require importers to bid for licenses to import within that limit.

Addressing TIPRO'S convention in San Antonio, Carson answered criticisms of the present program by asserting that the program has not broken down, that imports are not mounting steadily, and that restrictions are adequate.

Carson said the program has achieved 95% compliance because now only 2 of 58 importers have failed to signify compliance, and 1 of the remainder may comply soon.

Actual crude imports into Districts 1 through 4 from July through March, Carson said, have been 17.4% below what the importers had originally scheduled to bring in, and have been only 2.3% above goal. On this basis the program has been 97.7% effective.

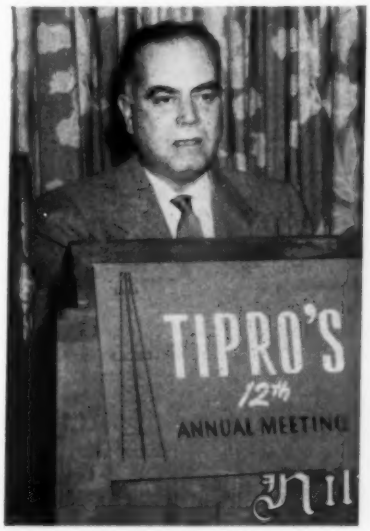
As originally scheduled these imports would have been 16% of domestic production, but from July through March they have been 13% and from September through March they have been 12.5%, or 0.5% above the goal.

No magic level . . . The request for 1954 ratio of crude imports to domestic production was ridiculed by Carson as the "magic level" at which all the industry's troubles are expected to disappear.

He pointed out that the same cabinet members who suggested the 1954 ratio of 10.6 in 1955, recommended a 12% ratio in 1957 as being proper for security reasons at this time.

He declared that if the 1954 ratio had been applied to crude imports into Districts 1 through 4 this year, it would have permitted Texas production to increase by 3 gal. per day per well.

The importation of refined products has not been judged a threat to national security, Carson said, because



Capt. M. V. Carson
. . . Products are not a threat.

86% consists of residual oil and "we simply don't make enough residual in Districts 1-4 to meet the demand."

Warning that rigid controls may lead to the more extensive federal regulation of the industry, Carson said:

"We have been seeking, consistent with the great principles of the free-enterprise system and consistent with the public good, to solve the current problems without resorting to rigid, mandatory controls. We will continue to seek such a solution. However, if mandatory controls become necessary —and today they are not—they will be imposed."

The resolution . . . TIPRO'S imports report contained a lengthy explanation and justification of the Ikard bill.

The resolution added that the present voluntary program does not and cannot achieve the objective of preserving a healthy and adequate oil industry in this country, though it acknowledged the sincere and outstanding efforts of Captain Carson in his assigned task of securing compliance with it.

Immediately after passage of the resolution, TIPRO members undertook a telegraph campaign to tell members of Congress that the Ikard bill was not offered as a means of trading or compromise but is the only legislation that will meet the objective.

Trade Bill Changed Little

. . . by House committee in tentative action. Present import system would stay virtually intact. Quotas not included.

BACKERS of the Ikard bill appeared at weekend to have lost the first round in their fight to have quotas for oil imports written into the Reciprocal Trade Act.

The bill is expected to be reported out by the House ways and means committee this week with nothing more than a streamlining of the present security clause under which the voluntary crude import program was set up.

The revision, tentatively adopted by the committee last week without immediate release of details, is believed to provide for a single investigation by the Office of Defense Mobilization, to be followed by a report to the President on which he may act.

The procedure followed under the present law involves an inquiry by ODM, followed by a finding that imports threatened national security. The President then may order an investigation and, if the ODM findings are supported, take action to curb imports.

Victory for Ike . . . If a simple rewriting of the security clause gets through Congress it will be a big victory for the administration.

Administration officials last week flatly ruled out a quota clause in the trade act as a means of curbing oil and other imports.

Any measure setting up quotas would be vetoed by President Eisenhower, they predicted.

Through the whole fight over reciprocal trade policy, the White House has been standing firm behind its request for a 5-year extension of the act without any strings.

The bill to come out of committee, however, is expected to offer only a 1-year extension. That would take the import issue out of the realm of politics in the coming congressional election campaigns, without closing the door to changes after the heat has died down.

If the committee bill provides a quicker way of dealing with import problems and makes it easier to get investigations started, it will be acceptable to the administration.

Such changes would not narrow the scope of the President's actions on appeals for protection, as would a mandatory-control provision, it is pointed out.

It is not expected, however, that the reworded security clause will satisfy the industries that are backing the Ikard bill as the only way to control imports effectively.

Rep. Frank Ikard (D., Tex.) has said he will offer the bill on the House floor if the committee doesn't accept it. If knocked down there it will be revived when the trade measure reaches the Senate.

Road ahead . . . The issue of import control has been the big roadblock in the way of starting the bill toward the House floor. That issue may now be settled, so far as the committee is concerned. But no matter what sort of bill is brought out it will find the going rough from there on.

Next stop for the measure will be in the House rules committee. Backers of mandatory import controls will seek to have it sent to the House under an open rule. That would permit the Ikard bill and other amendments to be offered from the floor.

If reported out under a closed rule, amendments other than those written by the committee in charge of the measure would be barred.

Neither type of rule, however, would prevent the offer of a motion to recommit the bill back to the ways and means committee. If adopted, such a motion could kill the measure. And that might be the last attempt of either backers or opponents of the trade bill if voting appeared to be going against them.

The strategy to be followed by the leadership will depend on a poll of the House to test the feeling on the bill that comes out of the ways and means committee.

The big aim of both the administration and the Democratic leadership is to prevent the trade measure from being turned into a high-tariff bill. That would be the effect of adoption of the Ikard bill, which could be broadened to cover many industries besides oil which have felt the effect of heavy imports, House leaders have said.

But some backers of the Ikard bill, at least, are confident that if it is offered on the House floor it will be adopted. And if not, they point out, the fight can be renewed on the Senate side.

TGT Taking Over Midstates

TENNESSEE Gas Transmission Co. plans to absorb Middle States Petroleum Corp. under a stock exchange approved last week by Middle States directors.

The offer, involving an estimated nearly $31 million worth of stock, is subject to approval of the holders of two-thirds of Middle States common stock.

Acquisition of Middle States would increase TGT's daily production of crude oil, condensate, and plant products by about 6,700 bbl. daily.

Principal offices of Middle States are in New York. Its oil properties are operated through a subsidiary, Midstates Oil Corp., with headquarters in Tulsa.

Under its proposal TGT would exchange 45 shares of its common stock for each 100 shares of Middle States common.

R. C. Graham, senior vice president of Tennessee Gas, said the company will start immediately to prepare a registration statement, which is expected to be filed with the Securities and Exchange Commission in about 30 days. August 1 is target date for completion of the transaction.

What TGT gets . . . Middle States owns an interest in 1,648 gross oil and gas wells or 496 net wells. Its producing property is located principally in Texas and Louisiana, with smaller interests in Oklahoma, Mississippi, New Mexico, Arkansas, and Saskatchewan.

The company sold its Kansas properties to Tennessee Gas in 1957.

Middle States also holds some 306,000 acres of undeveloped land.

Absorption of Middle States would increase TGT's daily production of crude, condensate, and plant products to about 33,700 bbl.

Gross income of Middle States totaled $9,835,913 in 1957. In 1956, prior to the sale of the Kansas properties, gross income was $10,364,218.

Net income, including special credit, amounted to $1,573,165 last year, compared with $1,034,094 in 1956.

A number of companies expressed an interest in acquiring Middle States after the company let it be known it would consider a merger or sale. Dillon, Read & Co., Inc., was retained to assist in obtaining offers.

Philip C. Dixon is president of both Middle States and Midstates.

Louisiana Gas Will Move to California Under Proposed Deal

A SENSATIONAL deal for a 1,600-mile, 30-in. gas line from Louisiana to the California border is being hammered out by Pan American Petroleum Corp., Tennessee Gas Transmission Co., Pacific Gas & Electric Co., and Southern California Edison Co.

The project, called Gulf Pacific Pipe Line Co., would be a subsidiary of Tennessee Gas Transmission Co., which now operates one of the country's largest systems from South Texas to New York and New England, and would be entering the territory of El Paso Natural Gas Co.

Gas would be purchased in the field from Pan American and other producers in the Bastian Bay, Old Ocean, and Sheridan fields by Pacific Gas & Electric and Southern California Edison for use as boiler fuel in California. Producers would receive about 23 cents an M.c.f. for a volume of gas which would range from 175,000 to 400,000 M.c.f. over a 20-year period.

The sale, since it does not involve resale in interstate commerce, would not be subject to Federal Power Commission jurisdiction. Tennessee would provide a strictly transportation service, a means which is becoming increasingly popular with producers and pipelines to limit federal regulation and expedite sale of gas.

Southern California Edison is now served by Pacific Lighting Gas Supply, whose out-of-state supplier is El Paso Natural. El Paso now has a project before FPC to sell 100,000 M.c.f. daily to the Edison company. It has been held up because FPC has questioned the adequacy of El Paso reserves.

Texas Holds Down Allowable

THE TEXAS Railroad Commission held the line on an 8-day allowable in June for the third consecutive month.

The June allowable is 2,479,174 bbl. daily. Due to fewer days in June than in May, the allowable is 51,888 bbl. more than the allowable set May 3 and 84,637 bbl. higher than the initial May allowable.

The independents generally favored an 8-day allowable for June. The big buyers were scattered in their nominations, ranging from Gulf Oil Corp.'s request for 8 days to The Texas Co.'s request for 11 days.

watching WASHINGTON

. . . with Bertram F. Linz

• Hussey will succeed Digby on FPC

INDEPENDENT GAS producers will lose one of the firmest advocates of nonregulation in Washington next month.

But they will gain another strong supporter when John B. Hussey, Louisiana's conservation commissioner, succeeds Seaborn L. Digby as a member of the Federal Power Commission.

Digby, who was named to the FPC in 1953, asked President Eisenhower not to reappoint him when his term expires June 22. He explained that he wanted to return to his native State of Louisiana.

Gas producers felt they had a friend in Digby as the only member of the FPC from a major gas-producing state and familiar with the problems of the industry by reason of his experience on the Louisiana Conservation Commission.

But in Hussey, the industry will have the same type of man. The 51-year-old Shreveport attorney has been a member of the Conservation Commission since 1935. And his appointment allays fears that still another member of the FPC would be chosen from a consuming state.

• Carson target of letter barrage

CAPT. M. V. CARSON, JR., the pleasant and efficient Navy officer who also wears two other hats, is finding his job as director of the Office of Oil and Gas more peaceful than that as import administrator.

As head of the OOG, Carson deals largely with facts and figures about which the public knows little and appears to care less.

But as import controller, he is on the receiving end of a barrage of letters from critics of the voluntary program, who frequently tell him that what he says ain't so.

Some of these letters warn Carson that he is being hoodwinked by the big companies. Others charge that he is hoodwinking the country.

The gist of many letters is that actual imports are far above what the good captain reports them to be. And the writers can always find a period of big imports to support that charge.

Some of these missives are from independent oil operators who don't like voluntary control anyway. But others seem to come from keen students of the newspapers who want to keep the Government on the right track.

• Gasoline tax increase threatens

OIL MEN are again worried about the chances of higher gasoline taxes. But this time the threat has been raised by the thinking of state as well as federal officials.

Higher taxes have been urged as the answer to two problems. One is how to help local transit firms in the many cities where they now aren't earning their costs. The other is how to raise more money faster for the stepped-up road building program.

Both the oil and automobile industries are against taxing the driving public to subsidize bus companies. They feel that if help is to be given it should come from the general revenues, not through a raid on auto drivers.

Higher taxes for highways could defeat their purpose by acting as a curb on driving, with loss of revenue to both state and federal governments, the National Highway Users Conference was told this month.

A cutback in driving would mean a loss of 10 or 11 cents in revenue on every gallon of gasoline not bought, it was pointed out. The states, whose tax rate generally is twice that of the federal Government, would be the big losers.

EXECUTIVES and officers listen closely to Chairman Long (inset) at opening conference as . . .

Texaco Tells Its Story to Key Men

THE TEXAS CO.'s 50,000 employes are getting a little better acquainted with each other—and with the company for which they work.

Key men from various Texaco departments and subsidiaries have just completed the first in a series of conferences in the Houston division.

Forty Texaco employes from 11 states and 5 foreign countries attended the first 2-week conference, May 5-16. Brief resumes of the company's far-flung activities were outlined in talks by officials of 18 departments and 2 subsidiaries.

"Skull" sessions in Houston divisional offices were interspersed with tours of the Texaco research laboratories at nearby Bellaire, the Port Arthur refinery, and other facilities.

The conference opened with addresses by Augustus C. Long, chairman of the board, and other top executives.

"The primary aim of the Texaco conferences," Long explained, "is to help our employes improve their understanding of the operations and the experiences of all our departments, and give them a broader grasp of how these fit into the company-wide structure.

"We expect the conference to provide the company with more highly skilled, better-trained management people, who will be able to maintain and expand our position . . ."

Similar conferences will be held in other areas during coming months.

CHATTING at informal get-together are (left to right) Chairman Long; J. O. Sanders, Atlanta division sales manager; Peter Wissel, senior analyst, finance and economics department; C. B. Barrett, senior vice president; and J. S. Leach, retired Texaco chairman.

TOURS of Texaco facilities included research and technical department's laboratories at Bellaire. Looking over equipment are (left to right) Bill Dean, guide, Gus Kaufman, W. R. Nichols, E. A. Neu, H. O. Woodruff, J. P. Dennis, and Walter Weiss, guide.

Esso Perfects New Gas

. . . designed to cut down engine deposits. Researchers find the fouling culprit is high boiling point aromatics.

MOTORISTS whose new autos are plagued with engine deposits were being told the story of a new gasoline throughout the 18-state territory of Esso Standard Oil Co. last week.

Esso is marketing a fuel which it claims will cut down deposits. Company dealers are being backed up with one of the biggest promotion campaigns in the company's history.

Esso Research & Engineering Co. developed the new product. Its researchers first identified the chief cause of engine deposits as high boiling point aromatics. Then they found a way to eliminate them.

New detective . . . The detective work to ferret out the deposit culprit is an interesting development.

A new radioactive tracer technique was developed to aid in determining which hydrocarbons caused the most harmful deposits.

It involved the synthesis of various hydrocarbons in which one or more of the normal carbon atoms was replaced with radioactive Carbon 14. Tests of various gasolines with the synthetic hydrocarbons added determined which type caused the most severe deposits.

Chief offenders were found to be higher boiling point aromatics, like long-chain benzene derivatives and naphthalenes. Here's the chain of events leading to that conclusion:

. . . **At 350° F.** aromatics, olefins, and paraffins all have a low deposit-forming tendency.

. . . **At higher temperatures,** deposit-forming tendency of aromatics rises very sharply, olefins considerably less, and paraffins still less.

. . . **At 450° F.** the tendency of entrained aromatics to foul is double that of olefins and quadruple paraffins.

How it's done . . . Esso refiners are eliminating these undesirable components by:

. . . **Closer fractionation.**

. . . **More selective choice** of feed stocks.

Since the components constitute only a minute fraction of output, their elimination does not greatly affect gasoline yield. Actually, the aromatics, while offensive in gasoline, are not objectionable in other petroleum products. They are recovered and used elsewhere.

Presence of high-boiling aromatics can be detected by ultraviolet light absorption. The light passes through almost all constituents of gasoline except the heavy aromatics. And by measuring the degree of ultraviolet-light absorption, the concentration of undesirable components can be determined.

Esso researchers found that only a very small concentration of heavy aromatics can be tolerated without increasing deposit formation and octane requirements. They set specifications for the new fuel to keep these below critical concentrations. When aromatics are maintained below this level, the other hydrocarbon constituents of the fuel are immaterial.

This was proven by comparison of a synthesized, wholly-clean fuel and a conventionally-processed gasoline with the heavy aromatics removed. Deposit-forming tendencies of the two were identical, indicating that further improvement in cleanliness was not needed.

Elimination of the heavy aromatics will not materially affect the olefin-aromatic-saturate ratio of gasoline. It is not likely to alter the trend toward higher aromatic content, but in fact could accelerate the latter. Lead susceptibility of the fuel is not affected so TEL concentrations are the same.

Future plans . . . Esso has plans eventually to market all three grades of its gasoline with the heavy aromatics removed.

In addition, premium Esso Extra and superpremium Golden Esso Extra will contain a new combustion-control agent designed to counteract residual deposits.

Esso claims that the agent changes the chemical nature of the deposits and reduces surface ignition without raising spark knock. It also cuts octane requirements, especially on high-compression models. That's the reason its use is limited to the premium and superpremium brands.

Esso Research & Engineering said that findings on high boiling point aromatics cost upward of $750,000, took 3½ years, and involved more than a million miles of road tests.

Distribution of the new gasoline to bulk storage began about 2 months ago and was completed to the company's 25,000 dealers last week.

Three Texas Floods Approved

SHELL OIL CO. last week was preparing to kick off a unitized flood in big KMA field in North Texas which it predicts will recover an extra 15,500,000 bbl. of oil.

The flood, which eventually will involve the field's Zones 1 and 2 under 4,640 acres, has been approved by the Texas Railroad Commission.

In other actions, the commission also approved Continental Oil Co.'s applications to carry out a propane-slug drive in the Frio F-4 reservoir of Rincon field, Starr County, and to start a pilot water flood in the Wolfcamp dolomite in Panhandle field, Hutchinson County.

KMA project . . . Shell plans to expand the KMA field project in stages, starting out by flooding 1,800 acres with 61 input wells and 59 producers (OGJ, Apr. 28, p. 73).

Production from the unit area has been about 22,600,000 bbl. since the first well was drilled in 1937. Shell estimates that this amounts to roughly 94% depletion of primary reserves. It estimates total oil in place originally at about 89,200,000 bbl.

Rincon LPG drive . . . Conoco's planned LPG slug drive in Rincon field will resemble a project already under way in Oklahoma's Short Junction field (OGJ, Apr. 28, p. 73).

Primary recovery from the Frio H-4 zone is expected to be poor—only about 432,000 bbl. or about 15% of original oil in place. The propane-slug drive, Conoco engineers feel, will boost oil take from the reservoir to at least 48% of that in place.

The project as planned will be carried out in four stages — injecting LPG successively through different input wells and employing water blocks to prevent undue loss of product.

Panhandle project . . . Conoco wants to start the Panhandle field pilot flood on its C. C. Whittenburg "A" lease.

If the test succeeds, the company plans to expand the flood to adjoining company leases and eventually take in 2,080 acres and 104 wells.

Production in the area is about 3 bbl. daily per well. The company says the project area is in the marginal stage of primary depletion.

Line Breaks Detected

. . . by new system which sounds an alarm at the nearest attended station and closes valves to seal off rupture.

A NOVEL monitoring system for spotting pipeline breaks has gone into operation.

The new line-rupture alarm system is installed on the 500-mile, 34-in. line moving Texas gas to the San Francisco Bay area. Pacific Gas & Electric Co. handled the installation.

Locating a pipeline break can be a lengthy undertaking when the line crosses such desolate country as the Mojave Desert, where portions of the line are 75 miles from the nearest maintenance station.

Since the line is the source of 70% of the gas used in the Bay area, a delay of several hours can seriously jeopardize continuity of service. Other sources of supply are available, but these require time to be switched in.

So far no ruptures have occurred on the line—but, should there be one, no time will be spent wandering aimlessly through the desert looking for signs of a line break. The new automatic devices, installed in strategically located valves and pressure limiting stations along the line, will:

. . . **Sense the break** from the abnormal or reverse flow conditions created.

. . . **Close valves** to isolate the ruptured section.

. . . **Report location** of the trouble to the nearest attended compressor station.

If there is any question as to accuracy of the indication, the operator can start an interrogating sequence to determine whether the alarm had been triggered by something other than a line break.

The unique monitoring system, which is in addition to pressure telemetering devices at 50-mile intervals, was described by J. H. Stannard, Jr., PG&E gas engineer, at the recent San Diego transmission conference of the Pacific Coast Gas Association.

How it works . . . In the event of a line rupture, signals from the remote alarms nearest the break are sent to terminal stations on either side of the break. This is done by carrier frequency telemeter channels on the telephone system paralleling the pipeline.

The method of signaling is a two-tone transponder system, using pulse position coding to identify the remote alarm units which have operated. The transponder system, in which the terminal equipment interrogates the various alarms and only those in an alarm condition respond, was selected because of the recheck feature offered in the event two valves are actuated at the same time.

Ruptures are detected by a differential sensing system which uses the main-line valve as a differential metering device.

As long as flow is normal through the line, the pressure drop across the valve keeps a differential trip valve closed; no gas is vented to the atmosphere.

A reverse differential across the main-line valve, such as would occur from a line break, results in the trip valve opening. This allows 20 psi. gas to reach a pneumatic motor assembly which, operating through a gear reducer, closes the main-line valve.

The flow of gas to the pneumatic motor also operates a pressure switch which actuates the alarm system.

Where this break-sensing system was installed at pressure limiting stations, modifications were made in the existing controls to permit the trip valves to over-ride the normal operation of the automatic pressure limiting equipment.

There are few places along the line where a dependable supply of electric power is available. Thus the relays and transistorized transmitter and receiver at each remote alarm unit are battery powered.

The details . . . Each section of line is under surveillance of two terminal alarm units. One serves as a master station and the other a slave station, but this reverses automatically if the master fails to function. Should a break occur in the telephone line, at least one terminal will still operate.

When the alarm switch is closed at a remote unit, the 7.9 kc. receivers in both the master and slave stations sound an alarm. The master station then starts interrogating all remote units in the section of line by transmitting a train of pulses at 7.3 kc.

The stepping switches in the master unit, slave station, and the remote units all step up together. When the stepping switch in an energized remote unit reaches the point corresponding to its particular code, that unit again will sound an alarm in the terminal stations. Any other remote alarms that are energized likewise will report in.

If the alarm has been triggered falsely, the recheck shows this to be the case.

PIPELINE BRIEFS . . .

Continued support of the Harris-O'Hara bill was voted last week by members of TIPRO. Group also voted to try to secure amendments to keep gas produced by pipelines from enjoying any material advantage over gas produced by independents.

TIPRO sidestepped support of the Long-Yarborough bill to exempt from federal regulation all producers of less than 2,000,000 M.c.f. of gas annually. Instead, officials were instructed to work for change in Harris-O'Hara bill to exempt from control all gas producers completely independent of any control by interstate pipelines.

Contracts have been let on the first leg of a 300-mile, 6-in. products line from Amarillo, Tex., to Albuquerque, N. M.

Arey Pipe & Construction Co., Inc., Pampa, Tex., will lay the 105 miles from Amarillo to Tucumcari, N. M., for the project backers, Emerald Pipe Line Corp. (Shamrock Oil & Gas Corp.), Phillips Petroleum Co., and The Texas Co. This section is under way and should be completed July 1. The entire $4 million project is to be completed September 1. The line will move 25,000 bbl. per day.

Pioneer Gathering System, Inc., has flanged up a purchase contract with Magnolia Petroleum Co. and Pan American Petroleum Corp. for gas production in the Clayton Ranch and Addie areas of Crockett County, West Texas. Pioneer plans to lay 14 miles of 4½-in. gathering line and build a dehydration plant to serve the two areas. Work will begin as soon as FPC approval is granted.

Cosden Petroleum Corp. has leased and will operate a crude-oil gathering system serving Luther Devonian field of Howard County, West Texas. The line is owned by Gulf Oil Corp. The system handles about 6,000 bbl. of oil from the field daily. Cosden now becomes the purchaser for the oil.

Trans Mountain Oil Pipe Line Co. expects May deliveries to average 72,613 bbl. daily compared with 80,556 bbl. daily in April. This low

Big Holdings Sold

by Wrather group in East Texas to General American.

GENERAL AMERICAN Oil Co. of Texas is laying at least $2,200,000 on the line for a net 64 wells in East Texas field in one of the biggest deals in that area in years.

The purchase includes East Texas production owned by Wrather Petroleum Corp., Dallas, and affiliated firms. Reserves involved have been estimated as high as 2,385,000 bbl. General American also acquires United Gathering System, Inc., which gathers crude in East Texas field from roughly 170 wells.

Whether the purchase is strictly a cash deal or whether production payments or stock transfers are involved hasn't been disclosed. Financing, however, is being handled by the Republic National Bank, Dallas.

This is General American's second big oil acquisition in the past month. Earlier it bought Forest Oil Corp.'s share of the working interest in Dora Roberts field in West Texas for $16,000,000 (OGJ, Apr. 14, p. 76). Recoverable reserves from this purchase are estimated at about 13,000,000 bbl. of crude and condensate and 60 billion cubic feet of gas.

New Tool Finds Gas Leaks Quickly

A MOBILE leak detector, reportedly 50 times as sensitive as other devices currently in use, is being tested by Southern California Gas Co. in Los Angeles with some amazing preliminary results.

In one case, the infrared analyzer, which is attached to the front bumper of a car, detected a leak in a corner building while driving through an intersection at 20 m.p.h. In another instance, a leak was detected in a field off a highway while the car was going 45 m.p.h.

The analyzer is powered by a 6-volt battery. An amplifier broadcasts an audible signal when air samples, drawn through hollow probes attached to the front bumper, contain methane.

The gas company's distribution and transmission departments report the device appears to offer a good answer to the problem of inspecting large metropolitan areas at a faster clip.

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level of operation is less than half the 200,000 bbl. daily delivered for a time last spring. The 1957 average was 154,891 bbl. daily.

Forest Pipeline Corp. will transfer to Roberts Gasoline Corp. 49.6% interest in a 35-mile, 8-in. pipeline from Grieve Unit field to Platte Pipe Line Co. near Casper, Wyo. Roberts owns 49.6% of Grieve production. The Wyoming Public Service Commission has approved the transfer.

Humble Oil & Refining Co. plans to build a 39-mile, 24 and 30-in. gas line from Hankamer, Tex., in Chambers County, to Port Arthur. Construction contract has been awarded to Sharman, Allen, Gay & Taylor. The job will be under the direction of E. D. Singleton, spread superintendent for the contractor. Completion is scheduled July 1.

Sharman, Allen, Gay & Taylor also is laying a 12.5-mile, 30-in. line for East Ohio Gas Co. between East Richfield and Twinsburg stations in Ohio. The project will be finished June 10.

Gulf Interstate Gas Co. will use the industry's first X-56 high-strength pipe for 352 miles of 30-in. partial looping this summer of its line between Louisiana and West Virginia. The pipe, with yield of 56,000 psi., will be manufactured by Republic Steel Corp. and National Tube Division of United States Steel Corp. The previous highest strength line pipe was X-52, which has a yield of 52,000 psi.

Pipe for the Gulf Interstate job will have a 0.375-in. wall except in heavily populated areas, where 0.469-in. wall is specified. When Gulf Interstate is completely looped, the new pipe will permit higher operating pressures and therefore higher deliveries through the second line.

Cia. Shell de Venezuela has awarded a contract to Williams Brothers Sudamericana to build a 101-mile heated-oil pipeline system from Bachaquero field to Puerto Miranda on the east shore of Lake Maracaibo. The first 39 miles will be 30-in. The next 31 miles will be a dual line, one 31-in. and the other 34-in.

The new system will revamp Shell's lake transportation, handling onshore as well as lake production, and replacing some tankers and pipelines now in use. Capacity of the system will be 440,000 bbl. per day. It will deliver crude to an $84-million terminal (OGJ, March 24, p. 105).

Also for Pipeliners . . .

IN THE NEWS: Hussey will succeed Digby on FPC—it's seen as a good omen for the natural-gas industry (p. 101) . . . New diffusion technique perfected to separate helium from natural gas (p. 107) . . . Mid-Continent Pipe Lines announces plans for 1,500-mile, 30-in. crude line from Edmonton to Chicago refining area (p. 110) . . . Automatic double jointer going abroad for first time. It'll be used on Algerian crude line (p. 116) . . . Iraq crude line sabotaged during political turmoil in Lebanon (p. 117) . . . Crude line will be built from Dutch coast to West Germany (p. 117).

PLUS THESE TECHNICAL REPORTS: Three-stage separators handle two-phase flow (p. 176) . . . Who picks up the tab for LACT? (p. 192).

FIELD SCHOOL trains engineering aides to make routine tests in Atlantic Refining's production districts. New program means . . .

Engineers Now Do Engineering

ATLANTIC Refining Co. is nearing a goal long sought by oil management and engineers alike: Keeping field engineers full time on actual engineering work.

Most petroleum engineers estimate they spend a third of their time making routine calculations, running tests, and keeping records. Majority of this work requires very little engineering talent.

Atlantic started to do something about this waste of technical manpower back in 1956. And now the company is well on the way to accomplishing its goal.

It has created a new field-office classification: Production engineering aide. These aides lift the time-consuming, nonengineering tasks off the backs of the field engineers.

Atlantic now has eight such aides in the field.

They are former roustabouts, pumpers, accounting department clerks, and the like. With a minimum of training, these men were able to take over routine duties which were consuming between 25 and 35% of the working time of the production engineer in Atlantic's district offices.

The aides have three prime general functions. They:

. . . **Conduct** special tests of well operation and of lease and well equipment for engineering analysis.

. . . **Gather** and organize data from various sources — company records, personal observation and inspection, and from contacts outside the company—for use in engineering studies.

. . . **Run routine** calculations and maintain a variety of engineering records.

Some of their specific jobs are testing gas wells and calculating gas-oil ratios, running dynamometer and sonolog tests on pumping units, gathering and checking water samples for corrosion, and running potential tests and calculating potentials.

Applying old idea . . . Atlantic is believed the first company to attempt anything like this in production engineering.

But the idea of training nontechnical people to lift much of the burden of routine off technical personnel isn't new to the oil industry. It has, in fact, been used to great advantage for several years by oil companies in their research laboratories. Here "laboratory technicians" now handle most of the mechanical portion of the research work load, freeing the chemists, physicists, and mathematicians for the true research effort.

The engineer - aide program is a brainchild of Atlantic's production engineers themselves. The Dallas production - engineering group suggested such a program in 1956. Management approved the idea in 1957.

Training begins . . . The company began selecting eight trainee aides in mid-1957. In the meantime, it outlined an extensive, two-part training plan.

The trainees first went to the field for 9 weeks of roustabouting, pumping, material, and accounting work. This phase of training was handled on an individual basis in the production districts and was adjusted to fit the varying backgrounds of the trainees.

Early this year, the trainees were brought into the Dallas headquarters for 4 weeks of classroom instruction and field study as a group. They completed this in February and were assigned to districts stretching from Kansas to South Louisiana.

Some "postgraduate" work was continued in the field. The aides were trained further on such functions as testing gas wells and running GOR tests—necessitated because of the widely varying regulations between states regarding gas production.

Results good . . . The aides now have been on the job nearly 3 months.

That's long enough for Atlantic to do a bit of preliminary analyzing on the success of the project. And the results, it feels, are good.

The aides so far are doing an efficient job. And the production-engineering groups in the districts have taken well to the idea.

Atlantic management is convinced the company will benefit moneywise from the program, too.

On the face of it, the program has added to the tangible cost of running the Atlantic engineering department by eight salaries.

Adding to personnel costs at a time when most operators would like to cut down on payrolls appears a bold and unusual step.

But the intangible benefits, hard to pin down on a dollars and cents basis, that Atlantic will realize through better use of its engineers' time, it feels, will far outweigh the added salary costs.

Furthermore, Atlantic believes that the current slackening in demand for petroleum engineers is strictly temporary. The aide program will benefit the company more when the supply of engineers again becomes tight. The program then will reduce the number of engineers Atlantic would otherwise have to hire.

K. B. McAFEE examines fine, capillary glass tubes used in a new . . .

Method Found to Save Helium

A DIFFUSION technique to separate helium from natural gas has been developed in Bell Telephone Laboratories. The technique also can be used as a helium purification process.

Laboratory spokesmen say results already obtained indicate the process can be adapted to high-volume commercial separation and large-scale commercial purification of helium.

The new process involves passing a gaseous mixture, such as natural gas, over the surface of a bundle of hair-like capillary glass tubing which has a high permeability to helium and low permeability to other gases.

The gas mixture flows around the outside of the tubing under high pressure and the helium is recovered from the inside of the capillaries.

Diffusion through the glass increases rapidly with temperature. Experiments indicate that a cell containing enough capillaries to occupy about 2 cu. yd. could recover 1,000 cu. ft. of helium per day at room temperature with a pressure differential of 1,000 atmospheres, assuming a concentration of 1% helium in the gas mixture. Increasing the temperature to 400° C. would recover 100,000 cu. ft. of helium per day.

Adding to the possibility that the process may have a large-scale potential is the fact the capillary diffusion cell might be placed directly in a gas pipeline.

The technique could be of tremendous commercial value because the demand for helium in the United States has risen much faster than the ability to produce it.

About 90% of today's output is used by the Government or in government contracts in the atomic energy and defense programs.

The importance of helium was pointed up recently by Interior Sec. Fred A. Seaton, who disclosed a $250-million plan for private industry to build as many as 12 plants in or near fields to take the helium out of gas for storage for future needs. He said if private industry didn't want to build the plants, then the Government would (OGJ, May 12, p. 81).

Purification . . . K. B. McAfee, developer of the process, said a single diffusion step results in exceptionally pure helium.

Tests showed that even though an initial gas mixture might contain as much as 90% hydrogen and only 10% helium, that there was less than 0.0009% hydrogen in the helium purified by diffusion through the glass capillary tubes.

Angelus Will Merge

its holdings in Los Angeles Basin into Texam Oil Corp.

MERGER of Angelus Oil Co. of California into Texam Oil Corp., San Antonio, appeared a near certainty last week.

Directors of Texam and both directors and stockholders of Angelus have approved the merger agreement. Stockholders of Texam are expected to do likewise in a June 16 vote.

Terms of the merger have not been disclosed. But it is known that the proposal involves a reciprocal stock exchange.

If the merger comes off, Texam will take over more than 2,500 acres of former Angelus leases and certain overriding royalties in the Los Angeles Basin. It plans an extensive development program in the area.

The Angelus leases are in the Temple - Vermont, Hollywood - Vermont, Olympus Wilshire, Mar Vista, Monterey Park, and Western Washington districts. Along with the leases, Angelus holds overriding royalties in the King-Hollywood region bounded by the Union Oil Co. of California-Paramount Pictures and the Angelus Hollywood-Vermont areas.

Montana Leasing

is affected by legal method for fixing the market value.

EXCHANGING of 20-year limit oil and gas leases for indefinite term leases is a tough legal question in Montana today.

The Montana attorney general is studying the issue and may rule as to whether the state legislature or the State Land Board has authority to fix the market value of the leases when the exchange is made.

The legislature passed a law in 1953 providing for indefinite term leases on state-owned land. The law provided that the Land Board should set the terms for exchanging old 20-year leases on the basis of full market value. However, the statute did not spell out the method of arriving at the full market value. As a result, no leases have been exchanged.

The Montana Supreme Court, meanwhile, has ruled in other market value cases that the legislature, and not the Land Board, must fix the method of arriving at the market value.

The legislature will convene in January and probably will be asked to approve such a method.

Pumping-Depth Record Broken

ANYBODY got a deeper one?

This sky-scraping pump jack sits atop Shell Oil Co.'s candidate for the title of "world's deepest pumper."

The well is Shell's State GA 5 in Caudill field, Lea County, New Mexico, which is bottomed at 13,600 ft. in the Devonian. It took over the title when the rod pump was lowered from 8,700 ft. to 13,000 ft. in an effort to hike production and to evaluate the pumping capabilities of the GA 5 under an extreme bottom-hole pressure drawdown of about 4,500 psi.

Shell's claim is backed by Bethlehem Steel Co. in its Sucker Rod Handbook. Downhole, the well now is equipped with a 1¼-in. bore insert-type production pump, and a tapered 1-in., ⅞-in., and ¾-in. string of sucker rods.

The pumping unit itself is the largest crank counterbalance beam unit manufactured (see photo). Dwarfed by the unit are (left to right) D. H. Trahan, Roswell division production superintendent for Shell; John Jones, lease operator; and George Goodpasture, production foreman.

The sampson post towers 20 ft. And the horse's head soars to a height of 34 ft. at the top of the stroke.

The giant Lufkin unit is powered by a Waukesha 6 WAKU engine and operates at the rate of eight 14-ft. strokes per minute. Maximum rod load at this pumping rate is 29,000 lb. Well production averages 19 bbl. of oil and 135 bbl. of water a day.

Shell says it has had no difficulty producing the well with its deep pump setting.

Phillips Near Depth Record

THE WORLD'S drilling-depth record could be broken next week.

Phillips Petroleum Co.'s deep test in Pecos County, Texas, was drilling past 22,044 ft. last week at the rate of 30-to-50-ft. per day. Should it continue to average about 40 ft. per day, the 1-EE University will drill past the current record depth of 22,570 ft. during the week of May 25.

Phillips officials said the wildcat was in the Devonian for the fifth time last week and is searching for the Ellenburger, which it already has found briefly on two or three occasions.

The currently projected depth is 23,000 ft.

Another deep Pecos County test, Phillips' 1-A Montgomery, was drilling below 20,000 ft. in limestone last week. The well is 15 miles southwest of the 1-EE University and is projected to 22,000 ft.

The 1-EE University is located 13 miles east of Fort Stockton.

The world's deepest hole was drilled in 1956 by Richardson & Bass at the 1-L Humble-LL&E-State Lease 2414 in South Louisiana.

Oklahoma test . . . Meanwhile, drilling was halted temporarily last week on another test well that threatens the depth record for Oklahoma.

Shell Oil Co. was down to 20,102 ft. at its 5 Rumberger in the Elk City field in Beckham County. The company was conditioning gas-cut mud after the well started kicking. Samples at 20,097 ft. to 20,102 ft. showed sand with a trace of porosity but with gas show.

The well is seeking the Springer sand and has no specific projected depth.

The Oklahoma depth record is held by Magnolia Petroleum et al 1 Sterba-Ordovician in Caddo County. The test was abandoned last November after going to 20,426 ft.

FPC Bogged Down

in paper work. Whole new approach asked by Knappen.

THE FEDERAL Power Commission is buried in a barrage of paper work involving natural-gas regulations. It's virtually unable to handle the flood of applications for price increases and certificates of public convenience.

Russell S. Knappen, Tulsa manager for Foster Associates, gave that report to the division of finance of the API, meeting last week in Houston.

Knappen declared the situation could be relieved by:

. . . Enacting the Harris-O'Hara bill. It would permit intelligent and efficient regulation of the gas industry.

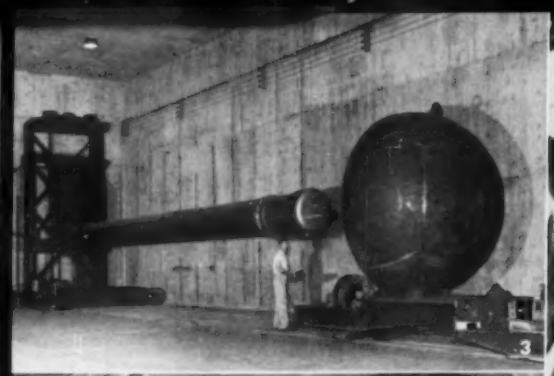
. . . Permitting gas to be sold like other commodities. Gas should be sold at its market price. No other industry makes sale contracts for 10 or 20 years, he said.

. . . Recognizing favored nations clauses as a program for selling gas at the market price. As the market value fluctuates, the price is raised or lowered for entire production from a field.

. . . Recognizing that utility-type regulations cannot determine the seller's price in many areas.

. . . Understanding that the tremendous increase in natural-gas industry volume in the last 10 years has been due to underpricing. It normally sells for less than the cost of fuel oil, coal, or electricity.

Knappen added that federal regulation cannot indefinitely keep natural gas underpriced. "The attempt to do so," he said, "will inevitably destroy the supply of gas for interstate commerce."



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1. 5-in. thick plate for reactor is fabricated at CB&I's Birmingham, Alabama plant.

2. Workman smooths seams on an assembled section.

3. X-ray machine for checking seam welds. Machines operating at 1,000,000 and 2,000,000 volts are used to completely inspect steel vessels as much as 10 inches thick.

4. 72-ton top section for reactor-regenerator is lowered into position under supervision of CB&I erection specialist.

Canada-Chicago Line Planned

MID-CONTINENT Pipe Lines, Ltd., has announced plans to build a 1,500-mile 30-in. crude line from Edmonton, Alta., to the Chicago refining area.

The company has applied to the Canadian Board of Transport Commissioners for permit to build the Canadian section, but construction is not planned immediately. The line may be deferred until U. S. import restrictions are eased.

Initial capacity of the line would be 150,000 bbl. daily. This would ultimately be increased to 300,000 bbl. The long-range plan calls for eight pumping stations with 83,000 hp. and storage facilities for 2,000,000 bbl.

About 600 miles would be laid through Alberta and Saskatchewan. The 900 miles in the U. S. would pass through North Dakota, Minnesota, Wisconsin, and Illinois.

Cost is estimated at $215,000,000. Financing would be through public sale of stock through Dominion Securities, Ltd., Toronto, and Kidder-Peabody & Co., New York.

U. S. subsidiary formed . . . Mid-Continent, whose president is Glenn Wilton of Toronto, has a dominion charter authorizing it to build pipelines in Canada.

The company has formed International Oil Pipeline Corp. as a U. S. subsidiary to own and operate lines on this side of the border. Principal headquarters will be in Canada.

The U. S. subsidiary is headed by W. C. Gilman, New York, whose engineering firm of W. C. Gilman & Co. made preliminary design and economic studies for the proposed line.

Engineering studies indicate that Canadian crude could be laid down in the Chicago area at competitive prices.

PROCESSING BRIEFS...

Petro-Tex Chemical Corp. has started construction of a high-purity isobutylene unit at its Houston plant. With capacity of about 2,000,000 gal. annually, the new unit will be "large enough to supply a substantial part of the present market for isobutylene," the company said. Production will be available in pressure-type tank cars in December. The product will have a purity rating above 99%. Petro-Tex is owned jointly by Tennessee Gas Transmission Co. and Food Machinery & Chemical Corp.

Construction will start about June 1 on facilities to manufacture carbon black master batch rubbers at the Port Neches, Tex., plant of Goodrich-Gulf Chemicals, Inc. The $1-million project is designed to produce a new type of dry man-made rubber for abrasive-resistant tires. Catalytic Construction Co., Philadelphia, will do the engineering and construction. The job will be completed late this year.

Imperial Oil, Ltd., will award a contract in August for construction of a $3-million Powerformer at its Regina refinery. Capacity will be 3,000 bbl. per day.

Tetraethyl lead prices were cut again last week by Du Pont Co. The cuts were 0.2 cent per pound for all antiknock compounds and were made effective May 14. New prices: Motor mix, 36.476 cents per pound; motor mix A, 36.07 cents, and aviation mix, 40.057 cents. In terms of TEL equivalent, new prices are: Motor mix, 59.33 cents; motor mix A, 60.33 cents; and aviation mix, 65.23 cents.

Ethyl Corp. effective May 14 reduced price of TEL 0.35 cent per pound. This second 1958 reduction puts prices at 59.33 for motor mix, 60.33 for motor plus, and 65.23 for aviation mix. A previous reduction of 0.5 cent went into effect April 1.

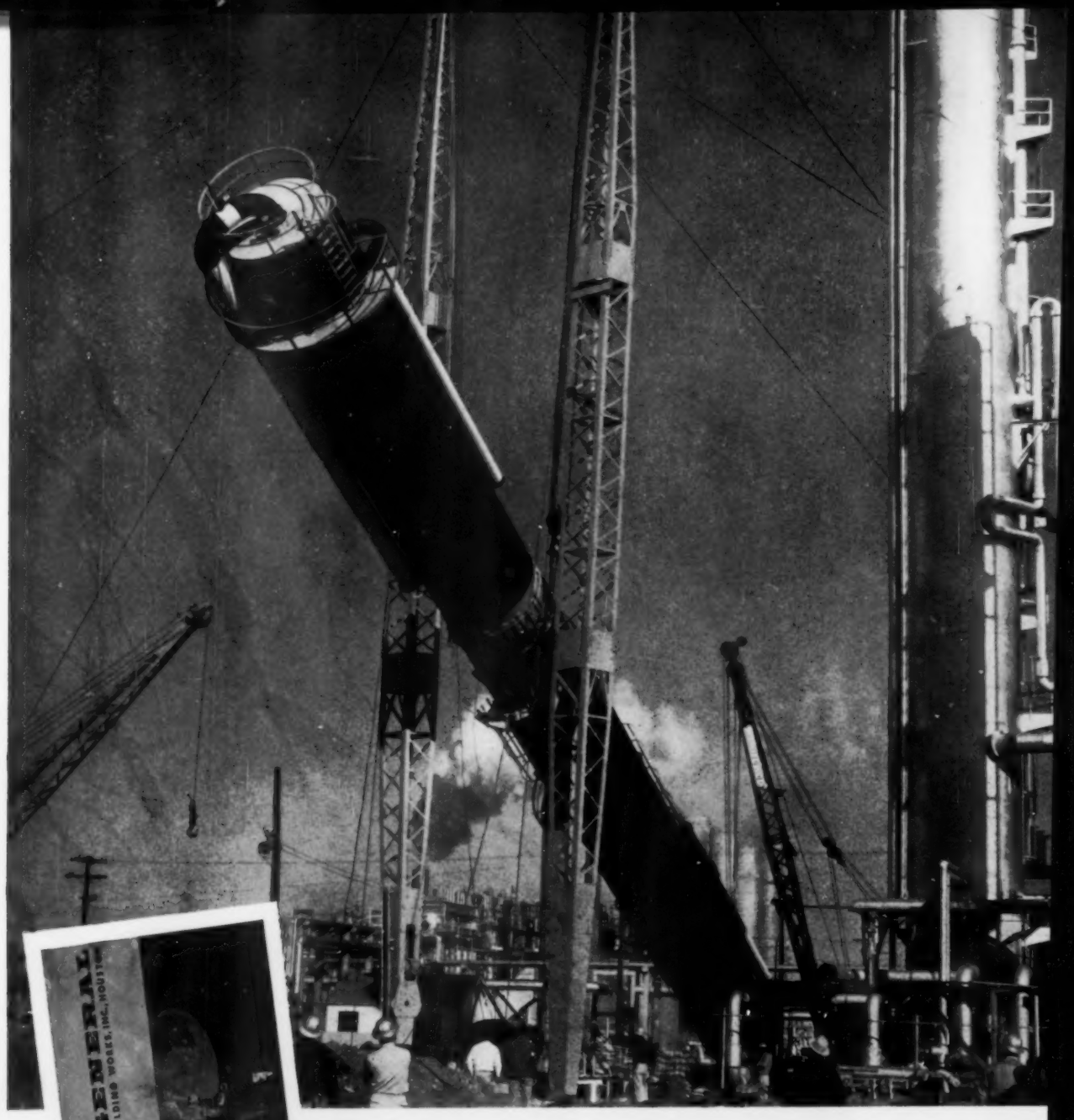
Cabot Carbon Co. will start construction shortly on a $1 million natural-gasoline plant near Glenrock, Wyo. The plant is scheduled for completion late this year. It will have a capacity of 8,000,000 cu. ft. of gas per day.

Beckman Instruments, Inc., will install an electronic computer-data processing system at Continental Oil Co.'s refinery at Ponca City. The system is designed to sustain peak operational efficiency in a catalytic reformer producing 10,000 bbl. of high-octane gasoline daily. Installation will be completed by June.

Also for Refiners . . .

IN THE NEWS: Foreign oil experts give TIPRO other side of oil-imports story (p. 98) . . . TIPRO endorses Ikard bill for handling imports (p. 99) . . . Esso marketing new gasoline designed to cut down engine deposits (p. 103) . . . At the API sessions in Los Angeles, refiners talked about octanes, coking, research, missiles, corrosion, and Unifining (pp. 119-122).

PLUS THESE TECHNICAL REPORTS: Shell's waste disposal at Anacortes (p. 124) . . . Corrosion in cat reformers with naphtha pretreaters (p. 131) . . . New flare is smokeless and nonluminous (p. 136) . . . How hydrogenation improves cat cracker feed (p. 144) . . . New light on cat cracker feed preparation (p. 153).



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What Is U. S. Productive Capacity?

ONE OF THE MOST widely-read papers published by The Oil and Gas Journal in recent years was captioned, "Future Productive Capacity and Probable Reserves in the U. S." (OGJ, Feb. 24, pp. 105-119).

Author of the report was Warren Davis, evaluation engineer, Gulf Oil Corp., Pittsburgh.

The Journal has received numerous reprint requests for the article, along with comments—both pro and con—on Davis' conclusions.

In his article, Davis stressed three points:

1. Drilling Return: Davis arrives at "drilling return" by relating the barrels of reserve added per foot drilled to cumulative reserves discovered. Reserves added are API total reserve additions. Footage is total footage drilled each year. He relates drilling return to costs and uses it to determine the point when drilling will no longer add sufficient barrels per foot drilled to be profitable. He concludes:

A. A decline in the last 20 years in barrels added per foot drilled.

B. Drilling return in the U. S. will decline in the future, and it will restrict the amount of footage drilled.

C. The ultimate reserves of the U. S. will be in the range of 125 to 165 billion barrels.

2. Producing Capacity: Peak producing capacity in the U. S. will be about 9 million barrels daily in 1967.

3. Crude Price: A future crude price of $4 per barrel would limit the drilling return and result in a decline in producing and drilling by 1967.

Here are excerpts from a report, by a major domestic oil company's chief economist, to management on the Davis paper.

"WARREN DAVIS' PAPER presents an extremely conservative outlook—too low—for the domestic petroleum industry in terms of producing capacity and ultimate reserves.

"We do not feel that Davis' results present the most probable producing capacity or ultimate reserves. We think the productive capacity will sustain much longer, and that the future reserves are much higher.

"The conclusions of Davis are almost entirely dependent upon his use of reserves, and he is limited to API reserve additions. These in turn affect the drilling return, the most significant parameter. Our basic disagreement with Davis concerns the ultraconservative results which are produced by his drilling return data.

"His base chart of cumulative reserves versus barrels added per foot drilled is conservative for several reasons:

"1. If drilling in the United States were stopped completely, there would still be sizable reserves added from future water-flood projects and revisions to old fields. Future water-flood revisions from known reservoirs will total 10 to 12 billion barrels.

"2. Revisions in recovery per acre, other than water flood, will add another 10 billion barrels. Thus, Davis' curve of cumulative reserves, at the present moment, is low by at least 20 billion barrels; and these are barrels with no added footage.

"3. Another 10 billion barrels of extensions to fields (which would require additional footage) would also be added.

"4. These additions, plus present reserves and total production to date, indicate a current known recovery for the United States of about 125 billion barrels. This implies that the petroleum industry in 1957 has reached Davis' minimum estimate.

"Davis estimates the ultimate reserve for the U. S. in the range of 125-165 billion barrels. This is extremely conservative. Estimates up to 300 billion barrels have been made by other authoritative sources (see Chart 1, p. 114).

"Probable final estimates of reserves developed by wells drilled would give a completely different picture from that using API data. We do not have probable final estimates for the U. S.; however, we have plotted the information for all drilling in Oklahoma and Kansas (see Chart 2, p. 114). This illustrates how different these reserves results can be.

"The solid line is the footage drilled in 1946 through 1957 divided into yearly API reserve additions and plotted versus cumulative reserves. The dashed line is the same footage using probable reserves developed by wells drilled (and takes into account probable revisions to original calculations).

"The API curve is quite similar to the curve for the U. S. used in Davis' study. In contrast, the curve based on probable final reserve data is flat. Thus, using the same footage, but a different reserve concept, results in a totally different answer.

"There are other factors which could tend to flatten the drilling return curve:

"5. Increased spacing should result in increased reserves per well. In Oklahoma-Kansas, the average spacing increased from 11 to 16 acres per well, from 1942 to 1956. Well spacing has increased at a faster rate than increased well depth, resulting in a leveling of the trend of barrels developed per foot in Oklahoma and Kansas.

"6. Service-well and gas-well footage is included in the drilling return calculated by Davis. The footage associated with water floods is usually added in advance of the time matching reserves are added.

"7. Experience has shown a strong relationship be-

Congrats and $25 to WM. L. CAIN, Production Dept., Phillips Petroleum Co., Bartlesville, Okla.

Lone Star Steel, Joe Roughneck's solid source of supply for casing, tubing and line pipe, has completed an important part of its multi-million dollar expansion program . . a new stretch-reducing mill. This ultra-modern new facility makes API quality 2⅜" and 2⅞" tubing and 4½" casing.

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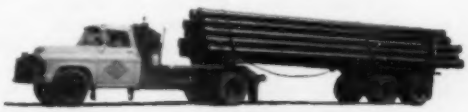

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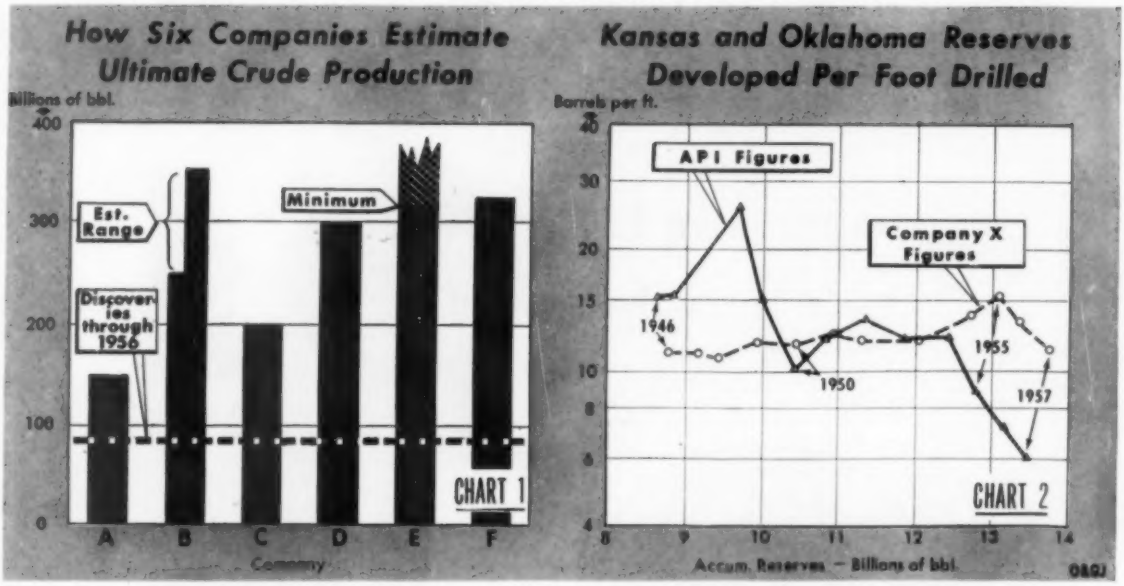


THREE OUT of six oil companies surveyed by The Journal estimate ultimate crude production at 300 billion barrels or more. One other, Company B, left a spread of between 250 to 350 billion barrels. (OGJ, Oct. 21, 1957, p. 70).

MORE OIL will be recovered per foot drilled by using reserve figures developed by an economist with a domestic company (dashed line). These reserve figures are larger than API figures, which Davis used.

tween maximum producing rates and maximum reserve additions.

"In the history of the oil industry, large reserve additions follow high producing rates or large production increases. A recent example is the Rocky Mountain area where the completion of new pipeline outlets to the Midwest resulted in substantial production increases. These in turn resulted in a wave of reserve additions, sharply increasing reserves in old fields.

"8. On the other hand, curtailed production inhibits reserve additions.

"The economics of the petroleum industry is best analyzed on a unit-cost basis. The best judge of an exploration program is a comparison of the dollars spent in exploration to the barrels found. Development costs should be related to barrels developed by the wells drilled. Lease and well expense and overhead should be related to barrels produced.

"Adequate records certainly should be initiated to determine the barrels found and developed by the industry, and therefore provide the basis for analyzing the economics of finding, developing, and producing crude oil.

"Davis' analysis could be improved by a more accurate determination of reserves found and developed. These barrels compared to current expenditures are a better indication of the producing industry's efficiency."

INDUSTRY BRIEFS . . .

Continental Oil Co. has completed an important discovery well between Ratherford and White Mesa fields in Utah's Paradox basin. The 4 Navajo-B, 1½ miles northwest of White Mesa field, flowed 1,344 bbl. of oil daily on ½-in. choke from Aneth-Pennsylvanian pay at 5,822-82 and 5,950-94 ft. This discovery offsets a block held by Aztec Oil Co. and Phillips Petroleum Co. where four tight holes have unofficially been reported as producers. There are dry holes between Continental's strike and White Mesa itself.

Medallion Petroleums, Ltd., and New Gas Exploration Co. of Alberta, Ltd., both Canadian independents, will merge their companies if shareholders approve a stock exchange proposal made by officers. Shareholders meetings are scheduled this month. Two shares of New Gas Exploration would be exchanged for one share of Medallion. Medallion had a gross income of $1,020,538 last year, compared with $747,150 in 1956.

A 3-day conference for drilling executives will be held this week at Shreveport by the Ark-La-Tex regional chapter of the American Association of Oilwell Drilling Contractors. The conference, May 21-23, is limited to 30 participants and is a continuation of a series of nine similar meetings held in 1956-57.

Discussion subjects include realistic bidding practices, personnel policies, principles of supervision, intracompany communications, and public relations.

Workmen's compensation insurance firms have lowered their sights in an effort to get higher rates for so-called "protected water" drilling. The firms have offered a compromise proposal calling for a new rate for such risks 60% above the onshore rate. The proposal was made during hearings on the question conducted by the Texas Board of Insurance in Austin. Previously, the carriers had held out for a rate 75% above the onshore rate—the same as is now in effect for "open-water" operations in the gulf off the Texas coast. They have contended in the past that operations in protected waters are just as hazardous as these offshore.

PLOTTING fire-fighting strategy for use against Iran's wild well, background, are American expert Myron Kinley, second from left, and a group of oil company officials and an Iranian army officer.

Old Record Burned Up

. . . by Iran's wild well. The 26-day mark went up in smoke of Ahwaz 6. Tactics to snuff out blaze may be changed.

IRAN'S WILD, burning well, Ahwaz 6, set a new record last week, but it's a dubious honor.

The fire has now surpassed the 26-day record set nearly 8 years ago by a blowout at Naft Safid.

The international consortium and Myron Kinley, Houston firefighter, weren't handing the new well any plaudits for its action.

Cratering at the wellhead is the latest development hampering Kinley's efforts to snuff out the blaze with explosives. The well has been blowing an estimated 100,000,000 cu. ft. of gas daily since it got out of control April 19. Last week it suddenly began to flow crude oil in a high-pressure jet from the casing. Another flow is coming from below the level of the derrick floor (OGJ, May 12, p. 97).

At least a part of this high-pressure flow is apparently outside the casing annulus and is causing the cratering.

Another plan . . . Kinley is still working to fish 650 tons of red hot drilling equipment away from the wellhead before trying to blow out the fire, but an alternate plan was being proposed.

Iranian Exploration & Producing Co., the operating company for the consortium, sent for engineers with Eastman International Co., Denver.

The Eastman firm, foreign operating branch of Eastman Oil Well Survey Co., is a recognized expert at killing wild wells by drilling relief slant holes into the well bore and killing the well with cement.

South Africa to Get Plant

SHELL Co. of South Africa is planning a 75,000-bbl. refinery at Durban.

The company has received approval in principle of the $70-million project from the South African government. The refinery will supply products to local markets and process some crude for export. It will use mostly Middle East crude.

Durban is the location of South Africa's only present oil refinery, a 21,100-bbl. plant owned by Stanvac. The government-owned SASOL coal-to-oil plant at Coalbrook produces 4,300 bbl. daily of gasoline, plus diesel and fuel oil.

ENI Activities Up

in Sicily and on mainland. Italians are pushing hard.

ITALY'S DOING it the hard way, but her refineries may soon be processing enough low gravity, sour Sicilian crude to make a small dent in internal demand.

AGIP Mineraria, an affiliate of the government-controlled Ente Nazionale Idrocarburi, has completed seven wells at Gela on Sicily's southern coast. One of these, Gela 5, set a depth record for the island when it reached 12,926 ft.

A gathering system has been built to serve 10 wells. Two more wells in the field are nearing completion and the thirteenth well has been spudded.

The company is building a 14-in. crude line to a new 1,100-yd. pier on the coast a short distance from the field. The new loading pier is designed to handle medium tankers (up to 18,000 tons). In addition to the crude line, the company is building a parallel 6-in. line from the pier to move gas-oil from tankers back to the field to aid in production of the heavy crude.

AGIP discovered Gela field 2 years ago in a Middle Triassic dolomite formation found at about 11,000 ft. in a faulted anticline. The discovery produced about 1,200 bbl. daily on pump and, according to the Italians, subsequent wells have tested at about the same rate.

The crude is 7° gravity and highly sulfurous, but the Italians regard the field as a major discovery.

Producing the heavy crude has been AGIP's problem. The company has been injecting small amounts of gas-oil into well bores and then mixing more gas-oil with the crude on the surface to make it flow through a pipeline.

On the mainland . . . On the Italian mainland, ENI has several wells under way in an effort to supplement its negligible Po Valley oil production with a new find.

ENI now has tests drilling in the Abruzzo and Marche areas of central Italy. Fermo 2 is drilling below 4,500 ft. Bonanno 2 is below 4,600 ft., and Villalfonsina 1, the deepest test in the region, is drilling below 10,345 ft. after an "interesting" show of gas.

In Appulia in southern Italy, Ugento 1 is drilling below 4,500 ft. This test is projected to below 13,000 ft.

High Price Tag Fixed

. . . on Middle East concessions by Japanese-Kuwait pact. Details disclosed and formal signing expected shortly.

THE PREMIUM tag is now firmly attached to prime Middle East oil concessions.

This much was established last week as preliminary details of the Japanese-Kuwait deal for a Neutral Zone offshore concession were revealed.

Basically the terms are much the same as those offered Saudi Arabia last December for the Saudi half of the Neutral zone offshore lands. The Kuwait-Japanese agreement has been "initialed" and a formal agreement is expected to be signed shortly.

The only difference yet reported is that Kuwait has been offered 57% of the profits, 1% more than that offered the Saudis.

This gave rise to speculation in the United States that the Saudi agreement may be renegotiated to increase this percentage split and make it equal to that offered Kuwait.

Ataru Kobayashi, spokesman for Japan Petroleum Trading Co., said in Tokyo that the firm is dickering with Geophysical Service Co., Dallas, to start seismic work just as soon as the Kuwait deal is formally signed.

The pact . . . Here are the known details of the agreement:

. . . The Japanese will pay an initial annual rental of $1.5 million to Kuwait. This is identical to the Saudi rental which the Japanese paid last month (OGJ, Apr. 21, p. 109).

. . . The Shaikh of Kuwait will appoint at least two members of the board of directors of a joint company to be formed for the operation.

. . . Kuwait's ruler has the option to buy 10% of the stock of the joint company if oil is discovered. He also can buy 10% of any subsequent issue of stock. The Saudi deal has a similar provision.

. . . Ten per cent of any production found will be sold in Kuwait and an additional 10% to friendly Arab countries. No oil from the concession can be sold to any purchaser which Kuwait regards as hostile.

. . . Kuwait will receive a bonus of $5 million when production reaches 50,000 bbl. daily.

. . . The Japanese agree to establish and maintain in Kuwait a research institute to study the country's natural resources and water supplies. The latter is a pressing need in the tiny little desert kingdom.

. . . Kuwait's ruler can call a halt to the whole thing if the Japanese have not found oil within 4½ years.

Others outbid . . . The Japanese offer, to the general surprise of western observers, left at least two groups of international oil companies standing with unaccepted bids in their hands (OGJ, May 12, p. 98).

A group headed by Royal Dutch-Shell are known to have made an offer of a sizable bonus but with the traditional 50-50 profit split.

Another offer made by Pan American International (Indiana Standard) and Hunt Oil Co. included a bonus and lion's share of a profit split.

Iran is different . . . In Iran, Indiana Standard found a different reception.

There the American company got acreage, just across the Persian Gulf from the offshore Neutral Zone tract, by offering a whopping bonus plus a partnership to National Iranian Oil Co.

Indiana Standard will pay Iran a $25-million bonus when the agreement is approved and has also agreed to spend $82 million for exploration. If the American firm doesn't spend the full $82 million during the first 12 years of exploration, it has agreed to hand Iran half the amount remaining at the end of that period.

The Indiana bid and its acceptance by Iran points up statements made months ago by the Shah of Iran that he expected NIOC, the government company, to become a real power in international oil.

The government's action in turning down high bonus offers of other international companies in favor of a partnership deal with the Indiana Standard affiliate indicates the country will try to use this device to build NIOC.

Whether they can be successful on this basis with further offerings of less desirable concession acreage remains the big question.

Jointer Due First Trip Abroad

. . . for speeding up welding job on 300-mile, 24-in. crude line from Algeria's Hassi Messaoud field to Mediterranean.

AUTOMATIC WELDING will soon be used for the first time overseas.

The technique will be employed in building the 300-mile, 24-in. line from Hassi Massaoud field in the Algerian Desert to the Mediterranean port of Bougie.

An automatic double jointer already has been trucked to Houston for shipment to Algeria.

It will be set up in a yard where two joints of pipe will be joined by the mechanized welding process before being strung along the right-of-way. This reduces by one-half the number of manual welds which must be made on the line.

The double jointer is being shipped to two French contractors, Ste. Entrepose and Ste. Parisienne pour l'Industrie Electrique, which are building the line as a joint venture for Ste. Petroliere de Gerancie (SOPEG).

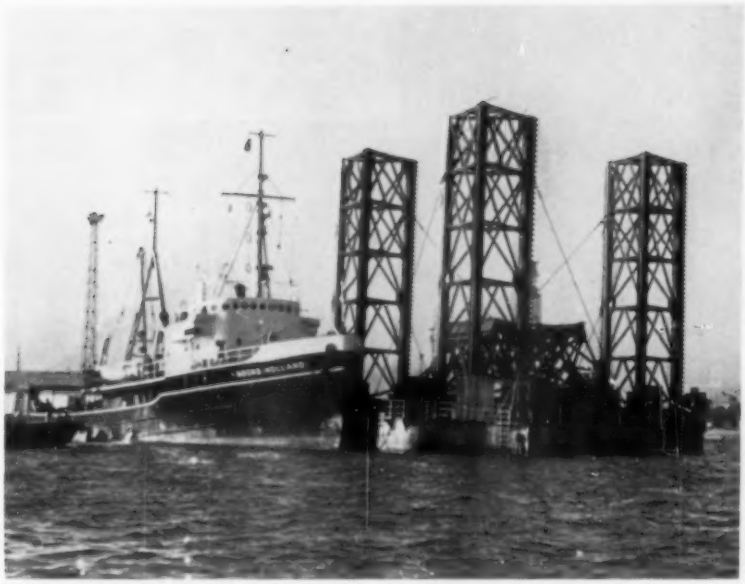
The operating company is a subsidiary of Cie. Francaise de Petroles (Algerie) and Ste. Nationale de Recherches et d'Exploitation des Petroles en Algerie, which are developing the major field to be served by the pipeline.

The line will provide a 100,000-bbl. daily outlet for Hassi Messaoud production, which now moves through a 124-mile, 6-in. pipeline from the field to Touggourt and from there by rail to the coast. Shipments averaging 6,300 bbl. daily in March are scheduled to rise to 8,500 bbl. daily (OGJ, April 14, p. 89).

The double jointer to be used is a Crose-Price-O-Matic unit. It was developed by H. C. Price Co., Bartlesville, Okla., and M. J. Crose Manufacturing Co., Inc., Tulsa.

It uses submerged-arc welding and will handle pipe from 22 to 42 in. in diameter. It is scheduled to reach its first field location early in July.

Use of the double jointer on the foreign job marks another step toward acceptance of this application of fully mechanized welding to pipeline construction. The only significant prior use of this automation technique was on Trans-Canada Pipe Lines, Ltd., last year. The H. C. Price Canadian affiliate, Price-Poole Constructors of Canada, successfully operated double-jointing yards on a 34-in. section of the line west of Winnipeg in Manitoba.



Platform Makes 10,000-Mile Voyage

ARAMCO'S first mobile platform for drilling in the Persian Gulf checked into Ras Tanura after a 10,000-mile, 15-week tow from Vicksburg, Miss.

The 800-ton outfit, shown at Port Said at the entrance to the Suez Canal, averaged 3 to 4 knots during the voyage.

The three-legged platform was built by R. G. Le Tourneau, Inc. It is designed to operate in conjunction with the drilling barge, Queen Mary, Aramco's other drilling outfit in the Persian Gulf. Other platforms of this type have been built to operate without a tender alongside.

The platform has a 136-ft. derrick. It will be able to drill a 13,000-ft. hole in 65 ft. of water.

It will take several weeks to equip the platform for drilling. It will drill Manifa 2. The field is the second offshore producing area discovered by Aramco. Manifa 1, located south of Safaniya and 8 miles offshore, was recently completed as a "prolific" producer (OGJ, Mar. 10, p. 102).

Iraq's Crude Line Sabotaged

A PIPELINE moving Iraq crude oil to the Eastern Mediterranean was cut last week for the second time in less than 2 years.

This time Lebanon, in the throes of a revolt, furnished the politically inspired sabotage.

The 16-in. pipeline was cut near Mamsoura just inside the Lebanon-Syrian border. Iraq Petroleum Co. officials in Beirut didn't know how the line was cut or how severely it has been damaged. All they knew was that no oil was coming through.

The Lebanon fork of the IPC system normally moves about 175,000 bbl. daily of Iraq crude to the Mediterranean port of Tripoli. Here the crude is loaded aboard European-bound tankers at four berths.

The flow of oil to Tripoli was being diverted last week to the Banias portion of the IPC system. This leg carries about 275,000 bbl. daily, but its throughput can probably be increased to take at least a portion of the Tripoli crude.

The Syrian port of Banias can accommodate six tankers at a time.

The pipeline was cut during widespread political riots in Lebanon. IPC personnel had been instructed to stay indoors until the riots ended.

The pipeline system was put completely out of operation in November 1956, when Syrian saboteurs blasted two main pump stations in Syria after the Franco-British-Israeli invasion of Egypt.

Syria would not allow even a partial repair of the system until mid-March 1957. It has been less than a month that the IPC system began to approach its former capacity.

Crude Line Started

from Rotterdam to Germany. Completion due in 2 years.

A NEWLY-FORMED company will build and operate a pipeline carrying crude from the Netherlands coast to West Germany.

Rotterdam-Rhine Pipeline Co. has started preliminary work for the line from the Rotterdam area to Germany's heavily industrialized Ruhr. The 185-mile line will have an initial capacity of 150,000 bbl. daily. It will be completed in about 2 years.

Two of the parent companies each have a reported 40 per cent ownership. They are the Royal Dutch-Shell Group and a joint participation by Gelsenburg Benzin, A.G. and Mobil Oil, A.G. Caltex has 20 per cent.

The system will help supply an 85,000-bbl. refinery Shell has under construction at Godorf, a 71,000-bbl. refinery now in operation at Gelsenberg, and a 43,000-bbl. plant at Wesseling owned by Union Rheinische Braunkohlen Kraftstoff, A.G.

The Wesseling plant now refines crude for Shell. It will handle crude for Caltex when the Godorf plant goes on stream. The Gelsenberg plant uses Mobil Oil's locally-produced crude.

Another crude pipeline to the Ruhr is expected to open late this year. It is a 230-mile, 28-in. line being built from Wilhelmshaven to Cologne by North-West Oil Pipeline Co.

Refinery Contracts Let

CONTRACTS FOR the new 40,000-bbl. El Palito refinery of Socony Mobil Oil Co. de Venezuela have been awarded to M. W. Kellogg Co. and its subsidiary, Cia. Kellogg de Venezuela.

The awards cover design engineering, procurement, and construction.

The heart of the $28-million plant will be a 40,000-bbl. single-stage atmospheric distillation unit. It will include gasoline fractionation and stabilization.

Other process facilities will consist of a 6,000-bbl. catalytic reforming unit, and a caustic treating unit. Offsite facilities will include TEL blending, water treating and disposal systems, and utilities.

The refinery will be built 8 miles west of Puerto Cabello, at the Caribbean terminal of the new 211-mile, 20-in. pipeline from Barinas. The plant will be designed to process crude from the company's San Silvestre field in Barinas, but it will be able to take other available types.

Pakistan's Deep Well Is Dry

A STEAM-DRIVEN rig making hole at Bannh, West Pakistan, has drilled the deepest well ever sunk by Pakistan Petroleum, Ltd.

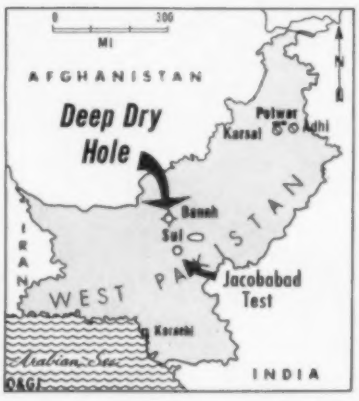
The rig took the well to 13,001 ft. before PPL called off the test as a dry hole. Bannh is located in the west-central area of the West Wing. The barren hills behind the rig are composed of eroded sandstone and clay (photo).

The well was the thirtieth spudded by the Burmah Oil Co. subsidiary. It took 6 months to drill.

PPL will drill a wildcat at Jacobabad, 60 miles southwest of Sui gas field. This test will be drilled to 5,500 ft. with a National 50 rig.

The Jacobabad location was staked on the basis of geological and seismic surveys, followed up by 15,500 ft. of core-hole drilling. Preparations for the test included the laying of a 13-mile, 4-in. water line.

The company is drilling ahead in two West Pakistan wildcats. Adhi, in the northeast part of the country, is at 3,760 ft. Karsal, being drilled jointly with Pakistan Oilfields, Ltd., is at 8,078 ft.



Early next year the company will drill its eighth well in East Pakistan. The test will be drilled at Chattak in the northeast part of the country near the Indian border. Because of 21 to 25 ft. of annual rainfall, most of it falling in the coming monsoon season, an artificial island must be built for the rig.

Petrochem Plant Is Dedicated

ITALY'S NEW petrochemical plant at Ravenna has been formally dedicated by Prime Minister Adone Zoli before its actual completion.

Portions of the big synthetic rubber and fertilizer plant have been in operation for several months, but all units in the plant are not expected to be completed before late this year. The completed complex will produce 60,000 tons of synthetic rubber a year and 750,000 tons of nitrogen fertilizers.

A part of the plant's rubber plant has been producing since early this year using a stop-gap supply of butadiene shipped by barge from the United States (OGJ, Dec. 2, 1957, p. 61).

Houdry Process Corp. has licensed and designed a dehydrogenation unit with an annual output of 20,000 tons of butadiene for the plant. A 14,000-ton styrene monomer plant built by Ste. Belge de l'Azote et des Pruduits Chimiques du Marly (S.A.B.) uses a Koppers Co. process to produce styrene.

The new petrochemical complex is being built for ANIC, S.p.A., which is controlled by Ente Nazionale Idrocarburi, the Italian government oil agency.

Fuel Supply Handy

for Aramco's new pumping station on crude pipeline.

ARAMCO WILL supply fuel the easy way for a new pumping station nearing completion on the 140-mile Safaniya-Ras Tanura crude pipeline.

When the Khursaniya station opens in mid-June, it will boost the capacity of the 22-in. line from 125,000 bbl. to 175,000 bbl. daily. The line started moving Safaniya crude a year ago to put the Persian Gulf's first offshore field on commercial production.

In planning the new station, Aramco engineers took advantage of the fact that the line passes the southeastern corner of Khursaniya field, one of the newer Saudi Arabian discoveries 63 miles southeast of Safaniya. The station is being built 2,000 ft. from Khursaniya 3, which will supply crude as fuel to four turbines driving centrifugal pumps.

Crude leaves the original pump station at Safaniya at 768 psi. Pressure drops to about 10 psi. when the oil reaches Khursaniya. The new station will push the pressure back up to 768 psi. in order to handle the additional 50,000 bbl. daily.

The four Ruston-Hornsby turbines are rated at 1,260 brake horsepower at 80° F. Aramco plans to overcome the problem of corrosion of turbine blades caused by vanadium compounds by adding magnesium sulfate in water solution to the fuel.

French Firm Sells First Rig

A FRENCH manufacturing firm has built and sold its first drilling rig under a license agreement with Continental-Emsco Co.

The rig, built by Ste. Nationale de Materiel pour la Recherche et l'Exploitation du Petrole, was purchased by Ste. COFOR. It is scheduled to start drilling for Cie. Francaise de Normandie on location near Compiegne.

The rig has a drilling depth range of 3,500 to 5,500 ft. with 4½-in. drill pipe.

NEWS from the API REFINING MEETING

At the Los Angeles Session, refiners talked about:

1. OCTANES: How the modern refiner will increase quality.
2. COKING: How to halt deformation in coke drums.
3. RESEARCH: Some important but less-spectacular reports.
4. MISSILES: Oil is taking a less-important fuel role.
5. CORROSION: A new method that cuts acid-gas corrosion.
6. UNIFINING: A report on the cost of operating four units.

1. Octanes . . . Ways to Increase Them

GASOLINE is becoming more and more a blend of tailor-made chemicals.

The refiner in time will reach the point where he is producing chemical-grade components which can be sold either as petrochemicals or as motor fuel.

These general trends were outlined for the API refining meeting last week by Davis Read, M. J. Sterba, and Nellson R. Adams of Universal Oil Products Co.

The trio of experts declared that gasoline pool octanes of 100 to 102 RON and superpremium ratings up to 110 RON are possible using only the refining tools known today.

But how soon—or whether— the industry will reach this quality level isn't known today, they said.

The UOP researchers analyzed a typical premium-grade gasoline with leaded octane ratings of 93 motor and 100 research. They gave this breakdown:

. . . **Use of many olefins** or normal paraffins heavier than pentane is limited.

. . . **Aromatics and isoparaffins** are the most desired constituents.

. . . **Naphthenes** are marginal.

A typical chemical breakdown, according to them, would show about 12% mixed normal butane and straightrun pentane, 36% each of catalytically cracked and reformed gasoline, and 16% alkylate.

This would break down to 52% paraffins, two-thirds of which are isoparaffins, 30% aromatics, 14% olefins, and 4% naphthenes. This chemical breakdown becomes ever more important as octane ratings rise.

Steps to high octanes . . . Numerous combinations and sequences are available to refiners in raising the pool octane number of gasoline.

One projection outlined by the UOP trio showed one such program in five steps. It produced pool octanes exceeding 100 by both research and modified Uniontown road ratings.

Beyond these five steps, three more were superimposed to boost the quality of superpremium gasoline fraction to 110 RON. Still further, an "ultimate case" was presented for making a pool gasoline of 107 RON and 100 MON with road-octane ratings in the 106-107 range.

These are technically possible, said

Read, by using processes which are now available to refiners.

Within each case, UOP computed the octane and yield results of the gasoline pool for three degrees of Platforming severity to 85, 90 and 95 research clear-octane levels. Abstracted data below include research-octane ratings and modified Uniontown road octanes of the gasoline pool leaded to 3 ml. TEL. A typical 35.5° API Mid-Continent crude is assumed for basic charge to the hypothetical refinery.

Here's how the cases look:

... **Case I**—Topping and vacuum distillation, Platforming of C_6-385° F. virgin naphtha, polymerization of propylene and butylene, fluid cat cracking of heavy gas oil (40% of crude to 60% conversion), with middle distillate and heavy vacuum bottoms to fuel sales. Results: RON of 97.4, 98.6, and 99.8 respectively; road octanes of 97.8, 98.7, and 99.7; yield on crude 46.5, 45.4, and 43.9%.

... **Case II**—Same as Case I except propylene to polymerization and butylenes to HF alkylation. Results: RON of 98.0, 99.1, and 100.2; road octanes of 98.7, 99.5, and 100.5; yield 49.9, 48.7, and 47.3%.

... **Case III**—Switch propylene to HF alkylation. Results: RON of 98.2, 99.4, and 100.5; road octanes of 99.1, 100.0, and 100.9; yields of 52.5, 51.3, and 49.8%.

... **Case IV**—Isomerization of all normal pentane from crude and Platformate, to isopentane, using Penex process. Results: RON of 98.8, 99.8, and 100.9; road octanes of 99.7, 100.4, and 101.4; yield 52.4, 51.2, and 49.8%.

... **Case V**—Platform C_7-385° F. virgin naphtha to 85, 90, 95, and 100 100 RON clear levels. Total hexanes from crude and Platformate are split, and normal hexane isomerized in a once-through Penex process. Results: RON of 98.6, 99.5, 100.1, and 101.5; road octanes of 99.5, 100.2, 100.8, and 102.0; yields 52.8, 51.8, 50.8, and 48.7%.

In these five steps, Case I showed an excess of butanes. The remaining cases required outside butanes for alkylation, ranging from 1.0 to 5.5% of crude. When correcting for this rejection to fuel and outside purchase of butanes, gasoline yields consistently decreased by about one-half per cent for one-number increase in road-octane rating.

From the advanced processing level represented by Case V, the authors proceeded to outline the steps toward splitting out a superpremium grade. Their Case VI assumed the conditions of Case V, Platforming to 100 RON plus cross fractionation. The light cat-cracked fraction plus the heavy reformate blended with butane for vapor pressure control would comprise 40% of total pool gasoline. Result was leaded research and motor-octane ratings of 104.4 and 92.7 respectively. The modified Uniontown road octane was 103.3 but the high-speed modified borderline rating dropped to 101.5 because of the absence of alkylate. The road rating of the remaining gasoline by both methods would be 101 octane.

Thus, the spread between superpremium and housebrand fractions could be adjusted by diverting alkylate to the former in exchange for light cat-cracked gasoline and even heavy reformate.

Case VII suggested backing Platforming severity down to the 90 RON level and Udex extracting the Platformate. All aromatic extract plus total alkylate and butane are blended to superpremium consisting of 35% of total gasoline, rating 110.7 RON and 99.6 motor octane leaded. Uniontown and borderline road ratings are 109.3 and 107.6 respectively.

The ultimate refinery . . . The UOP trio also extended known processing techniques to their ultimate possibilities.

They outlined a procedure for making a gasoline pool comprising more than 90% aromatics and branched-chain paraffins. This total gasoline fraction leaded to 3 ml. TEL would show the following ratings: 107 RON, 100 MON, 107 Uniontown road, and 106 borderline road octanes.

This ultimate blend results from several additional process steps beyond Case V. All normal butane is isomerized for alkylation. Ethylene and excess propylene are alkylated with benzene in the Alkar process to produce ethyl benzene and cumene. All cat-cracked gasoline is charged to a Unifining-Platforming operation.

No timetable was suggested for these extreme processing programs. It is obvious, however, that as refiners go to higher octanes they improve their positions to compete in the petrochemical field.

Read and his associates said that the basic processes now in general use in refineries, plus pentane-hexane isomerization and cross fractionation of cat gasoline and reformate, will meet premium and housebrand requirements for at least the next 5 years.

2. Coking . . . The Bulge Battle

KEY to halting that middle-age spread on delayed-coking drums is a lower water-quenching rate.

Coke drums take a beating in refineries because they are subjected to constant heating and cooling.

Vessel bulging and eight other problems resulting from severe thermal stress were discussed by N. A. Weil and F. S. Rapasky of the M. W. Kellogg Co.

Their study and remedial recommendations were based on visits to 16 delayed-coking units. They ranged in age from less than a year to 17 years service.

Shell deformation is the commonest problem. The Kellogg men found that it occurs in all coke drums in time. This can be held in check by watching the rate of water quenching. Steam stripping does little to drop coke temperature, so the whole quenching load is borne by the water that follows.

A unit quenching factor (UQF) limit was suggested. UQF equals water-quenching time in minutes divided by coke capacity in tons. When this factor is greater than 0.5, bulging is negligible. When it exceeds 0.8, growth is virtually absent.

The investigators suggest refiners keep this factor above 0.8 for conventional transfer-line inlet units. Where the transfer line enters at the center of the bottom cover, 0.4 will do.

Steam effective . . . Use of excess stripping steam also may serve to control coke-drum deformation.

In a prepared discussion, engineers of Standard Oil Co. (Ind.) reported they avoided trouble in this respect by using substantial amounts of steam followed by water at a UQF within the range cited for severe growth.

They concluded that excess steam can affect coke-bed temperatures and suggested that a correlation of this factor would be interesting.

Kellogg's conclusion on proper design of the bottom manway cover was termed particularly significant. The simple expedient of admitting charge, steam, and water and removing condensate in a single centrally located nozzle deserves consideration in designing new units and in modifying some existing ones as well.

3. Research . . . It's Picking Up

API Refining News

THE PACE of petroleum research is a swift one. Frequently, news of major discoveries or technical breakthroughs emerge from wraps in the industry's research centers.

But much more frequently the results of important, but less spectacular, developments are reported to the industry. Last week, these new developments made news at the API meeting in Los Angeles:

1. Computer Program for Analytical Labs.

The electronic computer has found a new use in optimizing the operations of an analytical laboratory.

Esso Research & Engineering Co. has translated the factors affecting service time and laboratory costs into a computer program. By varying the manpower, workload, and the time it takes to make analyses for affiliated companies, Esso Research can simulate a year's operation in 15 minutes.

This new tool will help improve the efficiency of the analytical lab.

2. Improved System for Measuring Sediment.

Today it is necessary to measure very low concentrations of sediment existing in gasoline, jet fuel, diesel fuel and other products.

Socony Mobil Oil Co. proposes an improved method of measuring this sediment. The use of commercially available glass fiber is suggested in place of sintered glass or asbestos fiber filters. Glass fiber filters remove particles down to 0.5 microns. They show more accuracy in the parts-per-million range because they do not adsorb soluble materials from fuel.

3. Using Heat to Speed Catalyst Analyses.

Use of an induction furnace generating temperatures over 2,500° F. will speed catalyst analyses, reports Standard Oil Co. (Ohio). Catalysts are completely decomposed, and such materials as sulfur, chlorine, bromine, and fluorine are trapped and evaluated as they evaporate from the melt.

4. A New Sensitive Test for Sulfur Content.

For the first time, a reliable method has come to light for determining sulfur in concentrations of less than one part per million.

American Oil Co. uses a specially prepared nickel catalyst which converts the sulfur in the sample to nickel sulfide. The sulfur in the nickel sulfide is then determined by established methods.

5. Automatic Microcarbon and Hydrogen Analysis.

An improvement on the conventional micro method for carbon and hydrogen has been developed by The Texas Co.

The tedious manual control of the combustion to carbon dioxide and water has been made automatic. This results in more precise control and more consistent results and allows the operator greater freedom during the test.

6. Better Measurement for Surface Areas.

A promising new method for determining surface area of solids uses nitrogen.

Shell Development Co. passes a continuous stream of nitrogen and helium through the sample at liquid nitrogen temperature. The adsorbed nitrogen is then eluted by warming the sample. The amount of nitrogen liberated is determined by thermal conductivity measurements on the exit gas stream.

This method obviates the need for vacuum techniques, is simpler, and requires less operator skill. It provides a permanent record and can be applied to lower-area samples down to about 0.1 sq. m. per gram.

7. New Instrument for Bromine Number.

Phillips Petroleum Co. is using a new instrument to measure the olefin content of experimental products.

Bromine is added to a sample by electrolyzing a solution of potassium bromide. The bromine is consumed rapidly, as long as any olefins remain in the sample.

When the saturation point is reached, the bromine colors the solution. This first appearance of yellow is detected by a sun battery which measures the decrease in the transmission of ultraviolet light through the solution.

The amount of bromine consumed is read directly from a recorder attached to the sun battery.

8. Developing a Precise Platinum Analysis.

Because of the large tonnages of platinum catalyst used today, exact measurement of the content of this precious metal in catalysts becomes important. An error of 0.01% on the charge to a typical reforming unit could mean about $10,000.

An X-ray spectrographic method developed by Sinclair Research Laboratories, Inc., and Engelhard Industries, Inc., gives rapid and accurate results. A 3-hour analysis occupying about 30 minutes of an operator's attention shows a precision of about plus or minus 0.003% platinum.

4. Missiles . . . Solid Fuels Win

THE OIL INDUSTRY to date has provided the push for nearly all the nation's guided missiles and rockets. All air breathers and liquid rockets use hydrocarbon fuels.

But the development of both solid and storable liquid propulsion systems for use with long range ballistic missiles is being pushed vigorously. This means that oil is on the way out as a missile fuel.

These accepted facts were outlined before the API by William M. Holaday, former research chief of Socony Mobil and now Director of Guided Missiles for the Department of Defense.

Holaday also told the dinner session he doesn't believe the over-all status of the Russian missile developments is a bit better than this nation's.

What's being done . . . The $6.4 billion outlay projected for next year's missile program is roughly 100 times the money spent on missile research in 1947, he noted. This year's program call for something over $5 billion.

All in all, the U.S. now has more than 30 missile systems in development and operational use, he said.

In all areas, missile and manned aircraft complement each other. But the days are numbered for the short-range manned interceptor and for the market for jet fuel which it burns. Surface-to-air missiles will take over this task.

On the other hand, Holaday believes the manned bomber is likely to be around for many years. Its numbers may decrease slowly, but the end of the jet bomber is not in sight.

. . . selected technical papers begin on p. 124.

5. Corrosion . . . T-52 Whips It

A NEW corrosion inhibitor holds promise for drastically reducing acid-gas corrosion in refinery and field-processing gas-treating units.

The inhibitor, designated as T-52, was specifically developed to combat a newly discovered type of corrosion in these systems.

This corrosion, called filiform, causes rapid metal deterioration in several parts of the treating units.

J. D. Sudbury, Continental Oil Co., Ponca City, Okla., outlined these points at a session of the API refining meeting in Los Angeles.

Alkanolamines corrosive . . . Alkanolamine solutions are frequently used in gas-treating operations to remove acid gases before transmission or further processing.

One of the major problems in the operation of these units is corrosion. And corrosion is most severe in regions where metal temperatures are highest and acid-gas concentrations are the greatest.

The equipment usually suffering the most severe corrosion includes the reactivator reboiler, the reactivator tower, rich-to-lean-solution heat exchangers, and the acid-gas cooler.

For the most part, corrosion control in these units has been limited to the use of alloys, inhibitors, and process changes.

Alloys have reduced corrosion rates some, but they are expensive. Inhibitors have suppressed foam and reduced amine carryover losses, and they have had a detergent cleaning-up effect on the units. But in most cases the inhibitors have had little or no effect on corrosion rates.

Process changes include filtering to remove iron sulfide, distilling, and neutralizing of amine solutions. Too, operating temperatures and pressures have been reduced. These changes have been moderately successful in some cases and unsuccessful in others.

Filiform corrosion . . . In an effort to solve these corrosion problems, Continental scientists took a look at the alkanolamine system.

First results led to the discovery of filiform corrosion. Thin, thread-like, hollow filaments form on the surface of the metal, with corresponding severe corrosion directly beneath the filaments.

Tests were made to develop a suitable inhibitor for this type of corrosion. None of the regularly used substances was effective. A number of organic materials was then tested, and one type was found to be successful. It is a condensation product of polyethylene-amines and unsaturated alcohols.

The corrosion rate in the system before the addition of T-52 was 96 mils per year. T-52, however, gave almost complete inhibition, the corrosion rate dropping to 0.8 mils per year.

Field tests successful . . . The T-52 inhibitor is being tested in two commerical units.

One quart per day is added slugwise to a gas-treating unit in Continental's Ponca City refinery. This keeps concentration in the reactivator tower at 200 p.p.m. or more.

The unit has operated for 8 months without failure. Previously, operating periods between failures have been as low as 3 to 5 months.

At Continental's Billings, Mont., refinery the inhibitor is added continuously to the reactivator at an over-all rate of 1 qt. per day. Test coupons show substantial reduction of corrosion in the liquid phase.

DIRECT OPERATING COSTS FOR UNIFINING
(Cents per barrel)

Feed type—	Reformer Charge and Stove Oil	Stove Oil and Diesel	Wide-Range Distillate	No. 2 Heating Oil
Unit size (bbl.)	16,000	900	5,000	12,000
Costs:				
Operating	1.1	1.1	1.1	0.8
Maintenance	1.6	1.8	1.2	2.8
Utilities	3.6	0.8	3.4	4.1
Catalyst	0.9	0.8	0.8	1.2
TOTAL	7.2	4.5	6.5	8.9

6. Unifining . . . The Cost Data

IN THESE TIMES, costs make news. Some new data on what it costs to run Unifining units drew attention last week.

Universal Oil Products Co. presented a basic discussion of modern uses of the Unifining process. Following the discussion, Union Oil Co., which licenses the process jointly with UOP, reported on recent costs of operating four representative Unifining units. The cost figures are summarized above.

In the first three columns, catalyst costs are subject to further reduction since the original charges were still in the units.

Operating costs include labor and supplies. They are based on the last full year of operation in each unit. The first unit has been on stream over 3 years, and original catalyst has been regenerated 10 times.

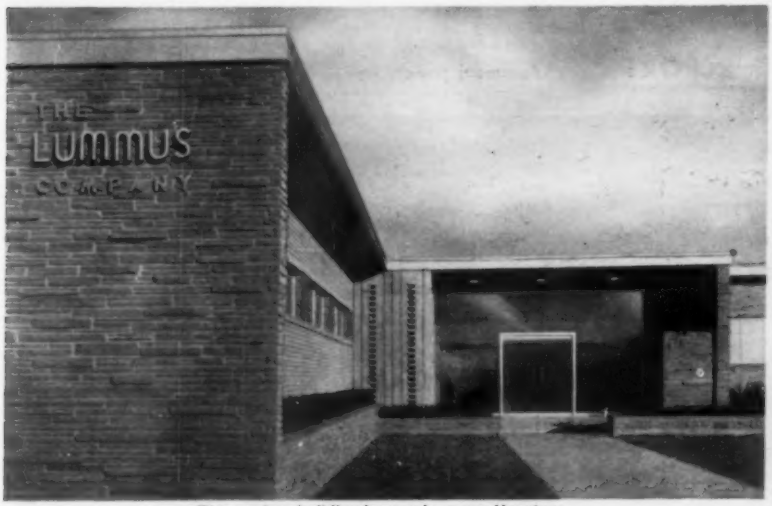
The second 3½-year old unit has two charges of original catalyst which are rotated in service. Each has been regenerated twice. Original charge in the third unit has been regenerated twice. In the fourth unit, in service over 3 years, 15 regenerations have been carried out.

No attempt was made to tabulate cost assignments for supervision, overhead, insurance, taxes, or hydrogen since they vary widely in definition and accounting practices among refineries.

Union underscored the low catalyst cost for Unifining with comparable figures for other processes. In cents per barrel of feed, the average catalyst cost for Unifining ran 1 cent, compared with 5 to 15 cents for platinum reforming and 3 to 6 cents for catalytic cracking.

Alkylation cost per barrel of product ran 4 to 7 cents for hydrofluoric acid and 15 to 30 cents for sulfuric acid. Butane isomerization catalyst costs 3 to 7 cents per barrel of isobutane, according to Union. In most cases the Unifining catalyst had been regenerated several times in the study.

ONE OF A SERIES OF ADVERTISEMENTS ON LUMMUS' WORLD-WIDE FACILITIES



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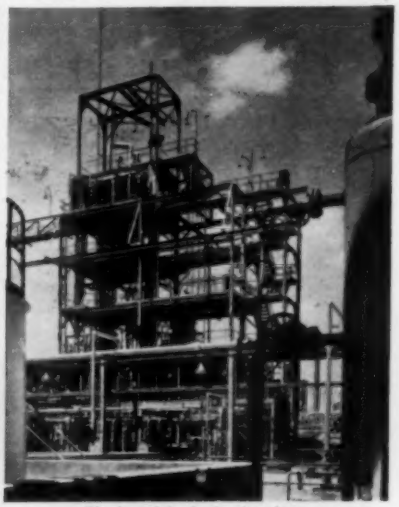
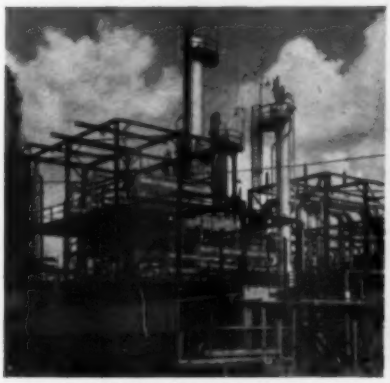
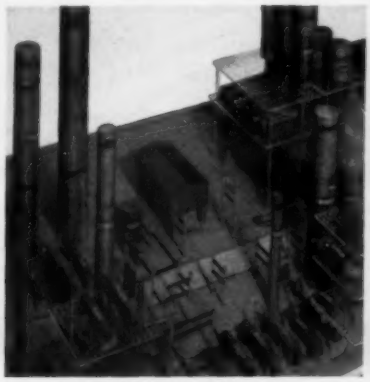

Bisphenol-A plant extension.


First ultraforming unit in the U. S.


$11 million ethylene oxide plant.

Complete refinery.

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The Lummus Houston office, like all Lummus engineering offices and subsidiaries throughout the world, can design, engineer, procure and construct any size or type plant for the process industries.

Lummus Houston, established in 1939, has to its credit scores of the more than 700 Lummus petroleum, petrochemical, and chemical projects completed throughout the world in the last half century.

Recent Lummus Houston projects, pictured above, include the first Ultraforming Unit in the United States, a Bisphenol-A plant extension with additional facilities for the manufacture of EPON Resins, an $11 million Ethylene Oxide Plant, and a complete refinery which has operated as one of the most profitable in the United States.

The highly trained staff is always ready to join forces with her six sister Lummus offices and subsidiaries—located in New York, Montreal, Maracaibo, London, Paris, The Hague—to make Lummus facilities easily available everywhere.

See Lummus on your next project.

* * *

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Beginning

REFINING REPORT . . . Technical papers from midyear meeting

TREATING AREA includes equipment consisting of a two-channel oil-water separator, two primary clarifiers, a biological trickling filter, an activated sludge unit with two clarifiers, and large detention basins for treated water. Fig. 1.

Waste disposal at Anacortes

When a company builds a refinery next door to a fisherman's heaven it has to be especially mindful of its manners—and waste. Here's how Shell managed to meet the neighborhood's requirements.

BY E. D. NEUMANN, C. J. RENO, AND L. C. BURROUGHS
Shell Oil Co.

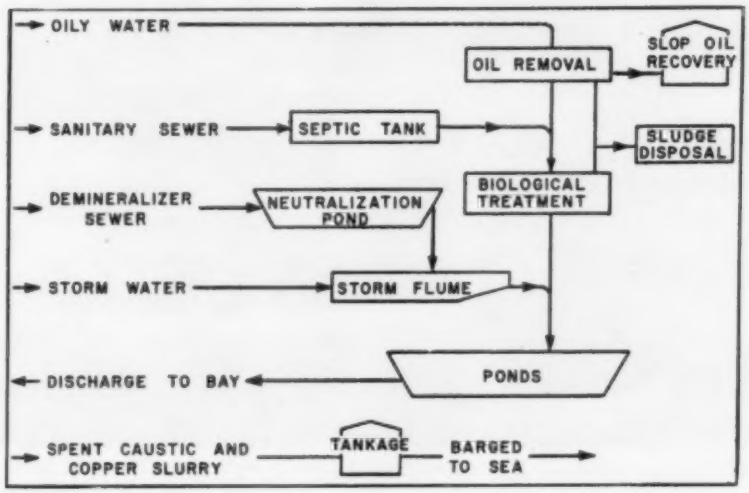
IN PLANNING for a refinery in the Puget Sound area, which has long been a sports and commercial fishing paradise, Shell Oil Co. made maximum efforts to insure that no harmful effects to wildlife resources and adjoining property would result from operation of the refinery.

Final choice of the site near Anacortes, Wash., necessitated very strict control of waste-water quality to protect clams, crabs, and rich oyster beds on both sides of March's Point.

After consultation with experts in the waste-water-treatment field and the Washington State Department of Fisheries and Pollution Control Commission, Shell chose to treat its waste water by a novel arrangement of known treating equipment.

Paper presented at API division of refining annual meeting, Los Angeles, May 12-15, 1958. Under the original title "Modern Waste-Disposal Facilities at Shell's Ancortes Refinery."

- All areas which are subject to oil spill and contamination drain to an oily water sewer. A two-channel API-type oil-water separator removes most of the oil from the waste water. Clarification and additional oil removal are accomplished by two primary clarifiers employing alum and activated silica as flocculating agents.
- Prior to biological treatment, effluent from the sanitary sewer septic tank joins the deoiled and clarified water which contains a chemical oxygen demand including phenols and sulfides. Biological treatment, accomplished by trickling filter and an activated sludge basin, is followed by clarification prior to ponding.
- Chemical, biological, and silt-type sludges are mixed, thickened, filtered, and calcined to a sterile ash.
- Spent chemicals from treating processes are barged to sea.
- After intermediate ponding to effect partial neutralization, washes from ion-exchange demineralizers enter the storm flume along with waters from all areas which are not subject to oil spill and do not require treatment. Treated and untreated waters are ponded in a retention system to provide for laboratory examination, retreatment if necessary, and subse-



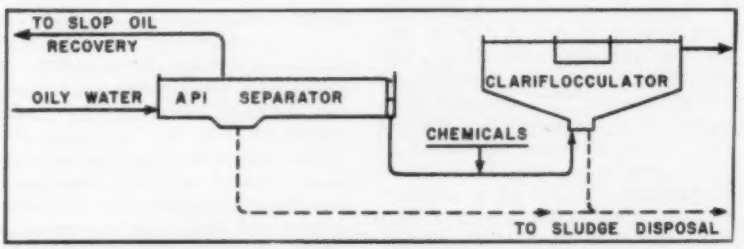
FOUR SEPARATE sewer systems deliver waste water to the treatment facility. Fig. 2.

quent disposal to the waters of Puget Sound on outgoing tide for maximum dispersal.

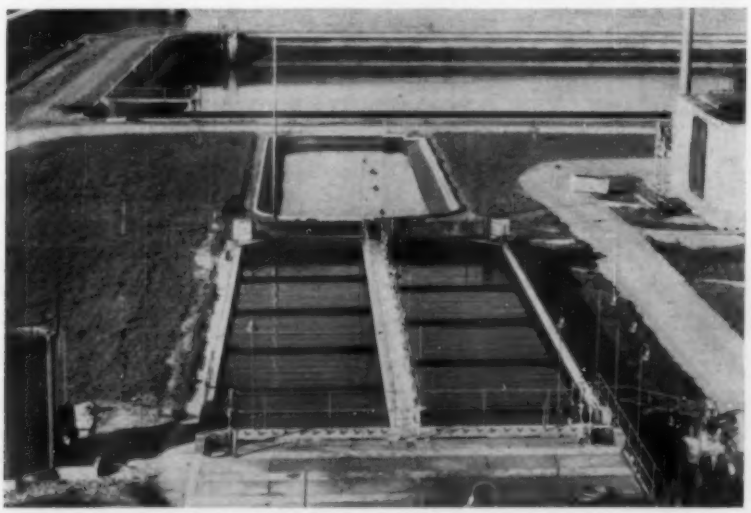
These treatment facilities have produced an effluent which has continuously met the rigid requirements of the Washington State Pollution Control Commission since the refinery startup in late 1955.

The treating area shown in Fig. 1, an aerial photograph, includes equipment consisting of a two-channel API-type oil-water separator, two primary clarifiers, a biological trickling filter, an activated sludge unit with two clarifiers, and large detention basins for treated water. Auxiliary equipment for sludge disposal includes a reservoir, a thickener, two rotary vacuum filters, and a kiln.

The building houses the rotary vacuum filters, chemical feeders, switchgear, and laboratory-office. Also shown are the storm flume, the chemical neutralizing basin, and tankage for slop oil, ballast, and spent chemicals.



OILY-WATER SEWER enters the two-channel oil-heater separator, where floatable oils are skimmed and sediments removed to a sludge-handling system. Fig. 3.



TWO-CHANNEL API-type oil-water separator. Forebays are 30 by 18 ft. and are provided with slotted pipe oil skimmers and bottom scrapers. Fig. 4.

Waste Streams

As shown in Fig. 2, four separate sewer systems deliver waste water to the treatment facility.

The oily-water sewer . . . handles all wash and rain water from the process areas, ballast water, drainage from the laboratory and garage, and stripped sour waters. The refinery has two steam-stripping units for removing hydrogen sulfide and ammonia from sour process waters, thereby eliminating a personnel hazard and objectionable odors from the sewer.

Additional benefits of these strippers are reduced load on the biological section of the treating plant, heat release, and increase in pH of the oily-water stream. As shown in Fig. 2, this stream undergoes oil removal, chemical flocculation, and biological treatment prior to disposal.

All sanitary wastes . . . in the refinery flow to a large septic tank located in the water treating area where bacteria digest the solids. The effluent from the septic tank joins the oily water stream prior to biological treatment.

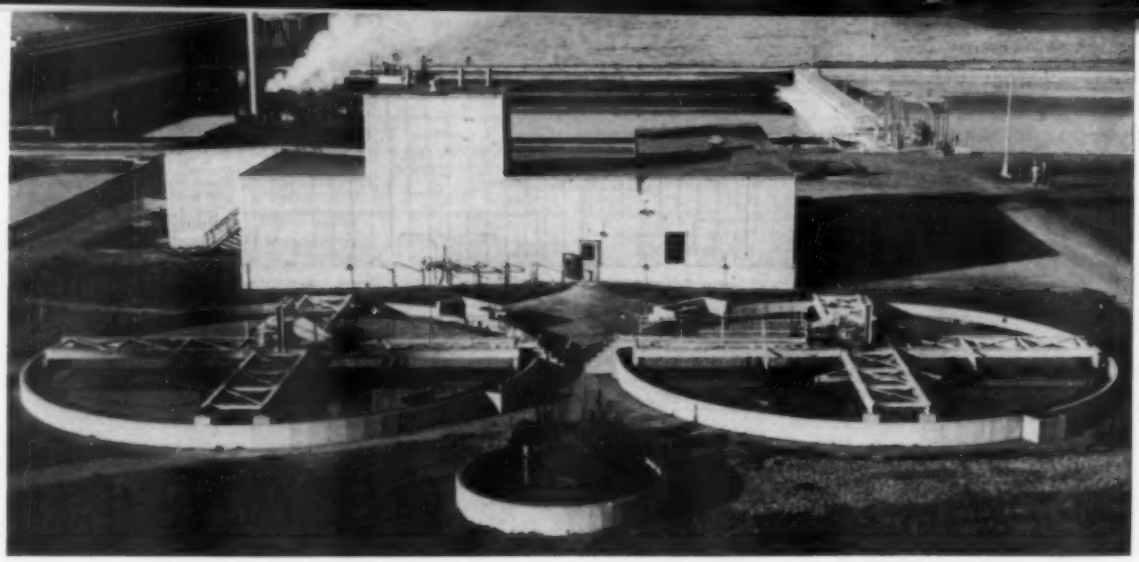
The chemical sewer . . . receives dilute acid and dilute caustic wash waters from the regeneration of ion exchange demineralizers used to soften boiler feed water. These alternate acid and caustic washes are ponded with the intent of neutralization. Although neutralization is incomplete due to lack of mixing in this pond, no effect on the total effluent from the refinery results because the main treated wastewater stream is highly buffered.

Rain-water runoff . . . from all parts of the refinery which are not normally subject to oil spills is collected in a "storm sewer" which empties into an open storm flume in the waste-water treating area. The storm flume is equipped with a slotted pipe oil skimmer and a trash-bar screen.

All waters from these four major sewers are ultimately combined in detention basins from which they are pumped to the end of the wharf 3,000 ft. into the waters of Puget Sound for disposal.

The treating area is also equipped with disposal facilities, as follows:

1. Spent caustic and copper slurry are collected in tankage at the effluent plant for barging to sea.



PRIMARY CLARIFIERS, sludge reservoir, and treating building. Fig. 5.

2. Slop oil is dewatered prior to returning to the refinery for reprocessing.

3. Sludges from the oil-water separator, the flocculators, and the biological section are thickened, filtered, and incinerated.

Oil Removal

A schematic flow diagram of the oil-removal section is shown in Fig. 3. The oily-water sewer enters the two-channel API-type oil-water separator, where floatable oils are skimmed and sediments removed to a sludge-handling system. Chemicals, controlled by a flow controller, are added to the skimmed water leaving the oil-water separator.

These chemicals form a floc in the center section of the primary clarifiers, absorb solids and oils, and settle to the bottom as a sludge which is removed to the sludge-handling system. Clarified water flows from the periphery of the clarifiers to the biotreatment section for removal of the biochemical oxygen demand (BOD) including phenols and sulfides.

Oil-water separator . . . A photograph of the oil-water separator is shown in Fig. 4. Water passes through an inlet distributor to the forebays which are 30 ft. long by 18 ft. wide; vary in depth from 6 ft., 3 in. to 6 ft., 2 in.; and are provided with slotted pipe oil skimmers and bottom scrapers. The forebays are covered to prevent loss by vaporization of volatile components of separated slop oil.

The water passes under a curtain wall to the afterbays which are 100 ft. long and 18 ft. wide; vary in depth from 6 ft., 2 in. to 5 ft., 11 in.; and are also provided with slotted pipe skimmers and slight scrapers for sludge removal. The separator is designed for a throughput of 2,000 gal. per minute of water. Skimmed oil is collected in a sump. Water which is skimmed with the oil is automatically returned to the separator by a pump controlled by an interface liquid-level controller.

Periodically, skimmed oil is removed to a 1,000-bbl. deemulsifying tank held at 150° F. for settling. After a time, oil having less than 2.5% water and sediment is transferred to a 10,000-bbl. slop-oil collection tank where further settling occurs. Oil containing more than 2.5% water and sediment is transferred to another 1,000-bbl. tank for further treatment.

The contents of the second 1,000-bbl. tank are checked periodically to determine if settling, filtering, or use of deemulsifying chemicals will be required to complete the cleanup job. Filtering is carried out whenever solids content is excessive.

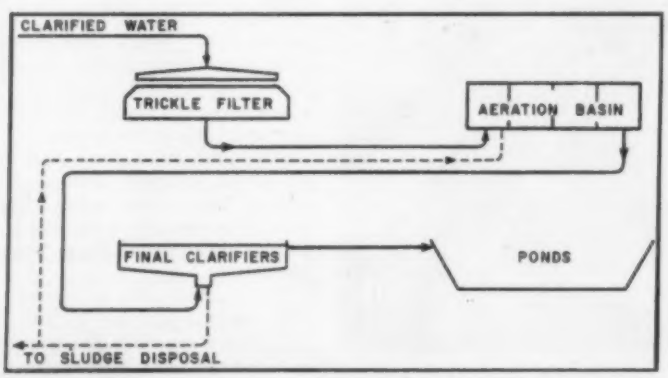
This procedure is necessary approximately once every 2 months. The use of deemulsifying chemicals is rarely necessary. Slop oil returned to the refinery for reprocessing has a water and sediment content of 0.1 to 0.2 vol. %.

Best operation of the oil-water separator is achieved when sediment is continuously removed to the sludge system and continuous skimming of the forebays is carried out. Normally, well over 90% of the slop oil separates in the covered forebays. When this is not done, oil content of the effluent from the separator increases, although additional skimming is carried out near the exit of the afterbays.

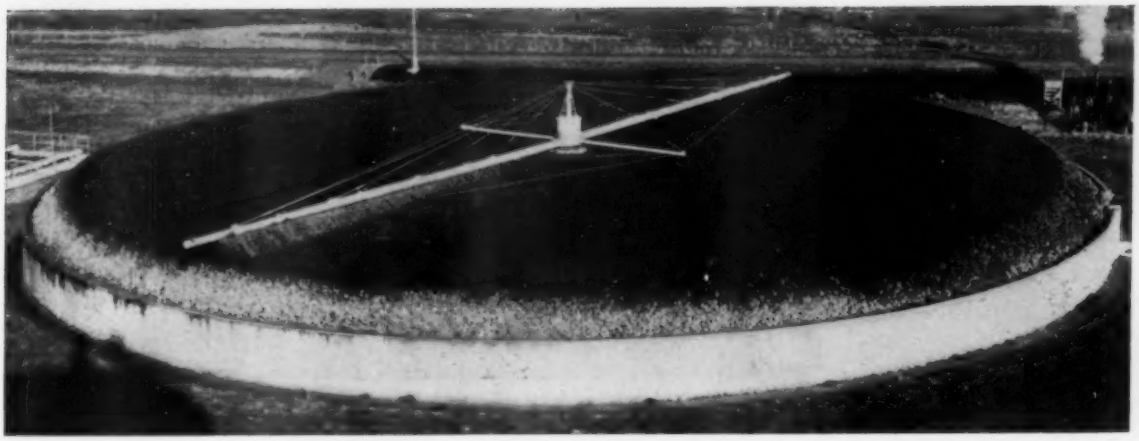
Addition of flocculation chemicals was originally based on the alkalinity of water leaving the oil-water separator, as in standard water-treating practice. Although flocculation was good for several weeks after the refinery was placed in operation, it soon began to deteriorate. Laboratory tests showed that an entirely new alkalinity range was necessary to give satisfactory flocculation.

After a time, it became obvious that each change in alkalinity range had resulted in the return to a pH value of 8.7 to achieve best flocculation. Subsequently, pH control has been used to control addition of floc-forming chemicals.

The pH of the separator effluent is adjusted to 8.7 by addition of lime



BIOLOGICAL-TREATMENT SECTION of facilities. Fig. 6.



TRICKLING FILTER consists of a rock pile surmounted by a water-driven distributor which is designed to handle 300 g.p.m. of water. Fig. 7.

and/or automatic addition of sulfuric acid, and dosages of alum and activated silica based on laboratory flocculation tests are added to the water to produce a floc.

A couple of interferences were encountered in striving for optimum flocculation. Diammonium phosphate added to the water as a nutrient for the activated sludge was found to interfere with the formation of a good floc. Consequently, it was necessary to add this chemical after the flocculation step.

Addition of ferrous sulfate to effect precipitation of sulfides prior to biological treatment also interfered with the formation of floc. Experience demonstrated that the biological treatment section was better able to cope with the additional sulfide load than with the floc carryover caused by the addition of ferrous sulfate.

The primary flocculators are shown in Fig. 5. They are concrete tanks 60 ft. in diameter, 10 ft. deep at the outer edge, and 15 ft. deep at the center. The center flocculation section is 31 ft. in diameter and 9 ft. deep. Bottom scrapers move settled floc to the outlet. A surface skimmer is provided for recovery of floatable oils. The flocculators are designed to handle 1,500 gal. per minute each.

Oil removal . . . The removal of oil at various stages of treatment is outlined in Table 1. You will note that the oil-water separator has produced an effluent containing 80 to 115 p.p.m. total oils.[1] Since the separator is generously sized for the flow handled, it is expected that more complete oil removal will be attained in future operation. Flocculation reduces the oil content to 25 to 45 p.p.m. Additional oil removal by the biological section results in a treated water containing 7 p.p.m. of oils, well within the required maximum of 15 p.p.m.

Biological Treatment

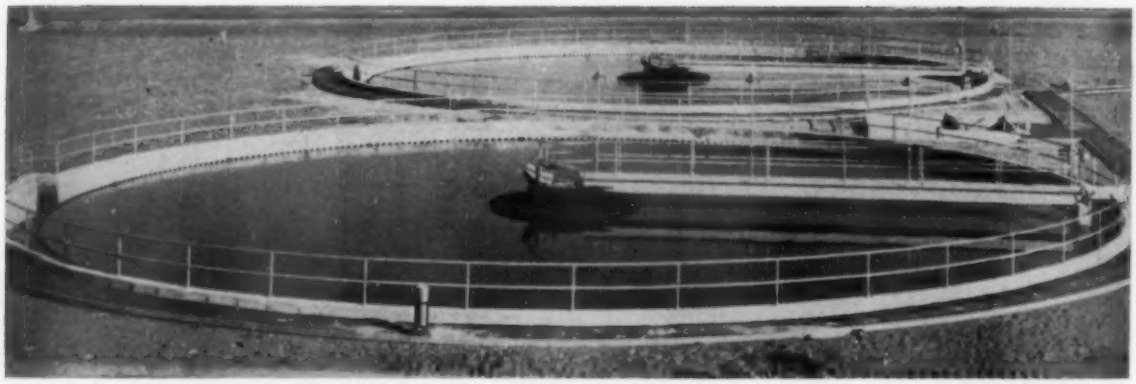
A schematic flow diagram of the biological-treatment section is shown in Fig. 6. Clarified oily water plus effluent from the septic tank is pumped over the trickling filter at a rate of 3,000 gal. per minute, including recycle of the trickling filter effluent as necessary. The water-driven distributor sprays the water over the trickling filter, absorbing sufficient oxygen to satisfy the aerobic bacteria which reside on the filter.

The water leaving the trickling filter enters the activated sludge section, consisting of a four-bay aeration basin, where it is intimately contacted with activated sludge and air and then proceeds to two final clarifiers which remove the activated sludge prior to ponding of the treated water.

Activated sludge is pumped from the clarifiers, and is either returned to the aeration basin to maintain the culture or removed to the sludge-handling system for disposal.

A photograph of the trickling filter is shown in Fig. 7. The trickling filter consists of a rock pile, 140 ft. in diameter and 10 ft. deep, surmounted

ACTIVATED SLUDGE AERATION BASIN consists of four concrete bays equipped with 64 jet nozzles for contacting air, water, and activated sludge. Fig. 8.



ACTIVATED SLUDGE CLARIFIERS are concrete tanks 60 ft. in diameter, 13 ft. deep in center, and 10 ft. deep at outer edge. They are designed to handle 2,000 g.p.m. of effluent. Fig. 9.

by a water-driven distributor which is designed to handle 3,000 gal. per minute of water. The trickling filter was expected to reduce the BOD content of 2,000 gal. per minute of water from 400 p.p.m., of which 40 p.p.m. is phenols, to 200 p.p.m.

Aeration basin . . . This is shown in Fig. 8. The aeration basin consists of four concrete bays 80 ft. long, 20 ft. wide, and 14 ft. deep. They are equipped with 64 jet nozzles for contacting air, water, and activated sludge; 1,500 gal. per minute of water plus activated sludge is pumped from the outlet of the aeration basin to the jet nozzles for contacting with from 1 to 3 M.c.f. per minute of air.

TABLE 1—OIL REMOVAL SUMMARY

	Oil in effluent (Parts per million)
Oil-water separator	80 to 115
Primary clarifier	25 to 45
Biological treatment	7

The activated-sludge section clarifiers are shown in the background of Fig. 9, just to the left of the aeration basin. These clarifiers are concrete tanks 60 ft. in diameter, 13 ft. deep at the center, and 10 ft. deep at the outer edge. They are designed to handle 2,000 gal. per minute of effluent, including a 500-gal. per minute load of activated sludge. Pumps are provided to return the activated sludge to the aeration basin or dispose of it to the sludge reservoir controlled by a time-cycle controller.

Data showing the results obtained in the biotreatment section are presented in Table 2 in terms of concentration in effluent from each unit. The load on the biotreatment section is 175 p.p.m. expressed as 5-day biochemical oxygen demand.[2] The trickling filter removes 85% of the biochemical oxygen demand, 98% of the phenol,[3] and all of the sulfides.[4]

Most of the balance of the biochemical oxygen demand, including phenols, is removed by the aeration basin. Water leaves the aeration basin with a dissolved oxygen content of approximately 2 to 5 p.p.m., increasing to 7.5 p.p.m. during ponding.

Further reduction of biochemical oxygen demand and phenols during ponding cannot be explained by dilution with storm waters.

In all, the plant removes 96% of the biochemical oxygen demand in the feed, including 99.5% of the phenols and 100% of the sulfides, and establishes an oxygen residual[5] of 7.5 p.p.m.

Detention Basins and Disposal

The detention basins are shown in Fig. 10. These two gunite-lined basins have capacities of 6 million and 5½ million gallons. The storm flume adjacent to the smaller basin has a capacity of 0.5 million gallons. Facilities provide a choice of several flow patterns to the basins. Water in these basins may be returned to the plant for further treatment, if necessary.

The basin water passes through a hay filter, and is then pumped to the wharf some 3,000 ft. offshore where it is injected into the bay 34 ft. below low mean tide during tide runs. This method of disposal insures rapid dispersion.

Activated sludge . . . Development of the activated sludge used for treatment of the refinery waste water is an interesting story. Prior to beginning of plant operation, activated sludge was obtained from a nearby municipal sewage-disposal plant. This sludge was fed a diet of chemical fertilizers and sulfate waste liquor from a nearby pulp mill to build up a large healthy population.

Adaptation of the culture to phenol consumption was then accomplished by adding a small continuous flow of cresylic acid. First additions of cresylic acid caused a heavy death rate among the bacteria; however, in due course, a strain of bacteria which were capable of actually removing phenols was selectively bred.

Development of these bacteria was encouraged by gradually increasing the amount of cresylic acid going to the culture until a phenol concentration up to 40 p.p.m., could be accommodated.

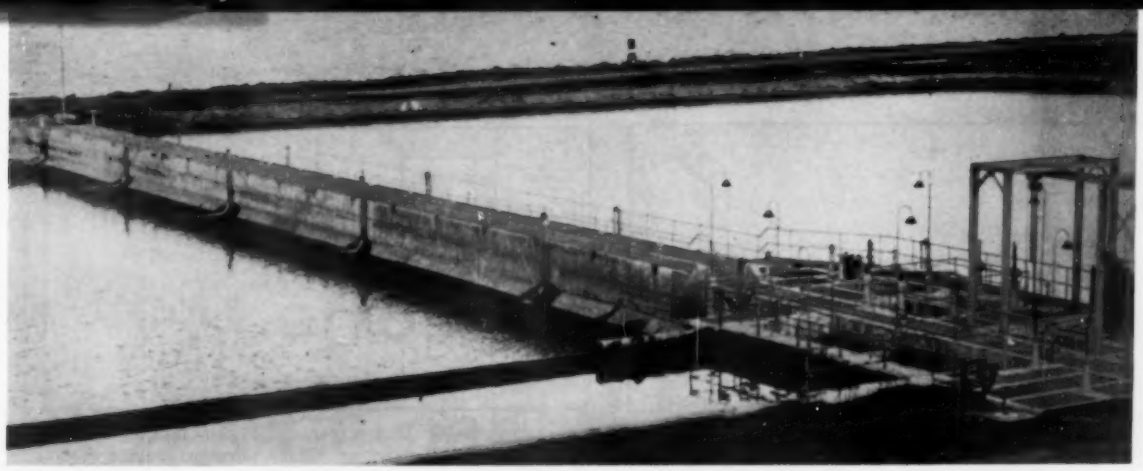
When the catalytic cracking unit was brought onstream, the activated sludge was switched from artificial feeding to the natural phenolic content of the refinery process-waste waters without difficulty. Activated sludge which is used for treating of refinery waste has only a slight odor compared to activated sludge from a municipal sewage-treating plant.

The major control over the operation of the aeration basin is the control of the population of bacteria. Population is measured by a suspended-solids analysis of water in the aeration basin and controlled by destruction of a por-

TABLE 2—BIOTREATMENT SUMMARY

(Flow of 1,200 gal. per minute)

	Concentration in effluent (Parts per million)			
	Biochemical oxygen demand	Phenols	Sulfides	Dissolved oxygen
Primary clarifier	175	30	13	
Trickling filter	25	0.6	NIL	
Aeration basin	10	0.2	NIL	2 to 5
Retention pond	8	0.15	NIL	7.5
Total removal, per cent	96	99.5	100	



DETENTION BASINS and storm flume. Basin water passes through a hay filter and is then pumped to the wharf 3,000 ft. offshore. Fig. 10.

tion of the activated sludge recovered in the final clarifiers.

Operating experience with a feed containing 0.5 p.p.m. to 3.0 p.p.m. of phenols has led to the relationship shown in Fig. 11 between phenol concentration in the aeration basin effluent and suspended-solids content of the aeration basin. As a result of this relationship, our plant is operated at concentration of activated sludge in the range of 300 to 500 p.p.m.

Biotreatment operating experiences . . . The reaction of activated sludge to sudden changes in its environment and its rate of recovery is of major interest to the operator or potential operator of a plant. The effect of a small increase in operating temperature and of shock loadings of phenols and sulfides can be demonstrated from operating experience to date.

The effect of a small change in temperature on the biological-treating section is shown in Table 3. Phenol removal was slightly improved when the temperature was increased from 65° F. to 70° F. These data are not conclusive, however, because changes of this magnitude are often observed over a similar period of time without explanation.

However, increased activity of the activated sludge is clearly shown inasmuch as the save-waste cycle had to be changed from eight save (return to aeration basin) two waste (to sludge disposal) to six save-two waste to approach the same concentration of activated sludge.

In Table 4, the effect of a shock loading of phenols is demonstrated. The excellent condition of the plant on the day (D—1) prior to the shock loading should be noted. As a result of the inadvertent dumping of spent caustic containing alkyl phenols into the oily-water sewer, the phenol concentration of the oily-water sewer was increased tenfold for a 24-hour period (D+0).

The trickling filter took the brunt of the shock and lost a large measure of its effectiveness. The aeration basin, however, improved in effectiveness. The presence of the overload was quickly indicated to the operators by the disappearance of dissolved oxygen in the effluent from both the trickling filter and aeration basin. Increased growth rate of the biosludge was also observed.

TABLE 3—EFFECT OF TEMPERATURE ON BIOTREATMENT

	D+0	D+1	D+2	D+3
Temperature, °F.	65	70	70	70
Phenols, p.p.m.				
Primary clarifier	36	41	36	35
Trickling filter	0.8	0.7	0.6	0.5
Aeration basin	0.25	0.25	0.23	0.22
Dissolved oxygen, p.p.m.				
Trickling filter	5	5	5	5.5
Aeration basin	5	5	4	4
Biosludge				
Concentration	460	580	650	525
Save-waste cycle	8-2	7-2	6-2	6-2

TABLE 4—EFFECT OF TEMPORARY HEAVY PHENOL LOADING ON BIOTREATMENT

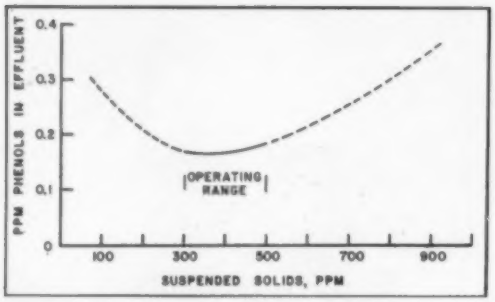
	D—1	D+0	D+3	D+5	D+7
Phenols, p.p.m.					
Primary clarifier	20	200	20	20	20
Trickling filter	0.5	70	0.8	0.6	0.5
Aeration basin	0.18	2.7	0.6	0.33	0.23
Retention ponds	0.13	0.14	0.96	0.33	0.19
Dissolved oxygen, p.p.m.					
Trickling filter	6.5	NIL	4.5	5	6
Aeration basin	6	NIL	3.5	5	6
Biosludge					
Concentration	500	600	800	550	430
Save-waste cycle	5-2	4-2	3-2	5-2	5-2

Early discovery of the shock loading and its effect on the biological treating section allowed time to dispose of all of the water in the detention ponds while water quality was within disposal limits. This technique allowed time for retreatment of water which obviously was leaving the treatment section with high phenol content. During the next several days, all effluent from the plant was recycled back to the biological-treatment section for retreatment.

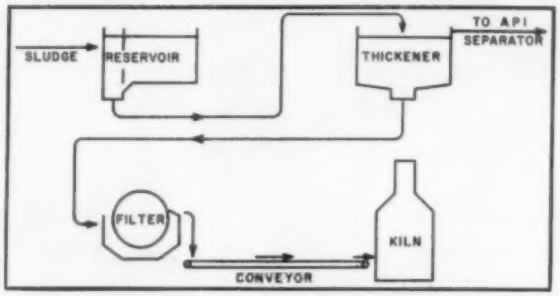
At the end of the third day, the trickling filter had almost fully recovered. It is interesting to note, however, that the aeration basin was much less able to adapt to a reduction of phenol content of feed to the basin. It is also interesting to note that the phenol concentration of the water in the detention basins exceeded the phenol concentration in the biological-treatment section effluent at this time.

Complete recovery of the biological-treating section occurred after 7 days, including return of the detention pond system to less than 0.2 p.p.m. of phenols. As a result of the large capacity of the detention basins, no undertreated water was discharged from the refinery.

The effect of a heavy sulfide loading on the biological-treating section is shown in Table 5. Operation of the plant just prior to the high loading of sulfide was not quite as favorable



AERATION-BASIN CONTROL showing that plant is operated at concentration of activated sludge in the range of 300 to 500 p.p.m. Fig. 11.



SOLIDS DISPOSAL. Sludge is pumped continuously to a thickener prior to filtration on rotary vacuum precoat filters. Fig. 12.

as in the previous example. A five-fold increase in sulfide loading occurred as a result of a shutdown of a sour-water stripper.

Although the trickling filter was readily able to remove the increased amount of sulfides, the phenol-reducing capacity was substantially decreased. Apparently the activated sludge consumes sulfides in preference to phenols. The aeration basin was able to handle this slight increase in load without effect. After only two days the plant returned to normal.

TABLE 5—EFFECT OF HEAVY SULFIDE LOADING ON BIOTREATMENT

	D−1	D+0	D+2
Sulfides, p.p.m.			
Primary clarifier	20	100	20
Trickling filter	NIL	0.3	NIL
Phenols, p.p.m.			
Primary clarifier	26	26	40
Trickling filter	1.3	3.0	0.75
Aeration basin	0.32	0.31	0.32
Biosludge			
Suspended solids	400	385	360
Save-waste cycle	9-2	7-2	8-2

Sludge Disposal

A schematic flow diagram of the sludge-handling system is shown in Fig. 12. Sediment from the oil-water separator, floc from the primary clarifiers, and activated biosludge are accumulated in the sludge reservoir.

This sludge is pumped continuously to a thickener prior to filtration on rotary vacuum precoat filters. Both the filtrate and thickener overflow are returned to the oil-water separator to prevent loss of any oils.

The reservoir is a concrete tank 20 ft. in diameter and 15 ft. deep. Two 120-gal. per minute pumps are provided to remove the sludge from the reservoir to the thickener, which is shown in Fig. 13.

The thickener is 30 ft. in diameter, 13 ft. deep at the center, and 12 ft. at the outer edge; it is designed to concentrate the sludge from 3% of solids-plus-oil to 6% of solids-plus-oil. Overflow from the thickener is returned to the oil-water separator. Thickened sludge is pumped to the filters by two 60-gal. per minute pumps.

The two rotary vacuum precoat filters are 8 ft. in diameter and 12 ft. long, having 300 sq. ft. of filtering surface each. They are designed to handle 20 gal. per minute at a solids-plus-oil content of 6% or 40 gal. per minute at a solids-plus-oil content of 3%.

The filtered sludge is conveyed to the gas-fired kiln which has 6 hearths and a total surface of 150 sq. ft. It is designed to handle 900 lb. per hour of filter cake having a composition of ⅓ filter aid, ⅓ oil, and ⅓ water.

Over-all Plant Performance

In Table 6, the over-all performance of the plant is compared with the Washington State requirements for waste water pumped to the waters of Puget Sound. Oil, sulfides, and mercaptans content are never a problem because of the high efficiency of the plant.

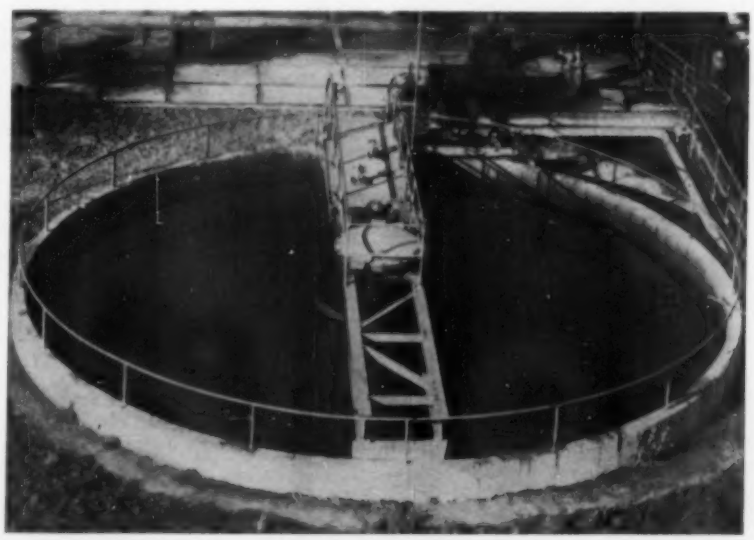
The plant has successfully reduced the phenols to below the limit of 0.2 p.p.m. set by the State of Washington which averages 0.15 p.p.m. of phenols. Control of the pH of the over-all effluent from the plant by addition of lime is necessary because biological treatment reduces the pH of the treated water to approximately 6.0.

TABLE 6—TREATED EFFLUENT

	State requirements	Average effluent
Content, p.p.m.		
Oil	15	7
Phenols	0.2	0.15
Mercaptans	0.5	NIL
Sulfides	0.5	NIL
pH	6.5 to 8.5	7.0

References

1. API Method 731-53, Manual on Disposal of Refinery Wastes, Vol. IV, Sampling and Analysis of Waste Water, 2nd ed. (1957).
2. Standard Methods for Examination of Water, Sewage and Industrial Wastes, joint publication of American Public Health Assoc. and American Water Works Assoc., 10th ed., p. 260 (1955).
3. API Method 715-53. Manual on Disposal of Refinery Wastes, Vol. IV, Sampling and Analysis of Waste Water, 2nd ed. (1957).
4. API Method 711-53, ibid.
5. API Method 724-53, ibid.



SLUDGE THICKENER is designed to concentrate the sludge from 3% of solids-plus-oil to 6% of solids-plus-oil. Fig. 13.

API Refining Report

What Socony Mobil learned about

Corrosion in cat reformers with naphtha pretreaters

BY E. B. BACKENSTO AND R. W. MANUEL
Socony Mobil Oil Co.

EXPERIENCE with catalytic reformers having naphtha pretreaters has borne out predictions that desulfurization of the charge to below 0.002% by weight of sulfur would reduce high-temperature hydrogen-hydrogen sulfide corrosion of carbon and low-chromium steels in the reforming section to a negligible level.

Inadequate desulfurization, caused by pretreater operating difficulties, has, in some cases, permitted scaling in reformers. Such sulfide scale, subsequently exposed to hydrogen and low hydrogen sulfide concentrations, has been reduced to metallic iron.

Although sulfide scaling in the reforming section is being eliminated in most cases, scaling in the pretreater must also be controlled. Corrosion rates in pretreaters have been, in most instances, approximately as predicted from laboratory data. Sulfide scaling has been prevented by the use of 18-8 chromium-nickel stainless steel and calorized coatings.

Paper presented at API Division of Refining annual meeting, Los Angeles, May 12-15, 1958, under the original title, "Corrosion Experience in Catalytic Reformers With Naphtha Pretreaters."

While sulfide scaling has been minimized, other problems have been encountered. The most serious problems and the control methods being used are:

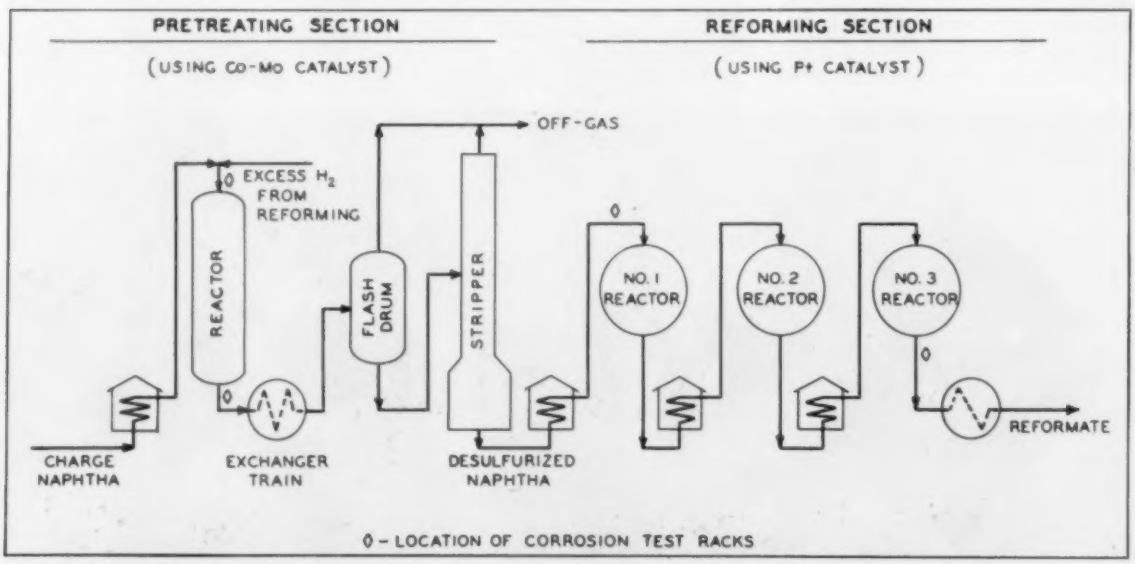
1. Corrosion and fouling by chlorides in low-temperature sections of the pretreater. Acid chloride corrosion has been controlled by injection of ammonia and inhibitors and by alloying with Monel.

Fouling, as a result of ammonium chloride deposits formed after hydrogenation of organic chlorine and nitrogen compounds in the naphtha, has been controlled by continuous or intermittent onstream water washing.

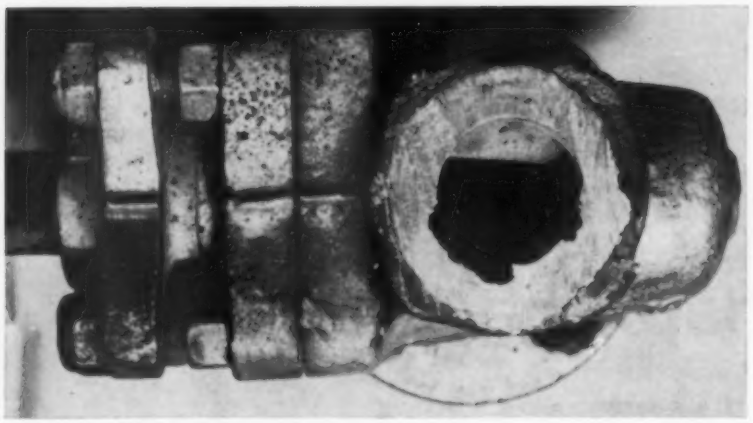
2. Transgranular stress-corrosion cracking of austenitic stainless steel by chlorides. This has been encountered, but is being prevented by washing piping and exchangers with water and dilate alkaline solutions during shutdowns.

3. Intergranular cracking of unstabilized austenitic alloy lining. This occurred in one pretreater reactor, probably as a result of polythionic acids formed by the action of wet steam on sulfide scale. This has not occurred in units where stabilized alloys are used and contact of wet steam is avoided.

4. High-temperature hydrogen attack. This has been observed on a few carbon-steel internal details in re-



SIMPLIFIED FLOW DIAGRAM shows how excess hydrogen from reforming is used to desulfurize the charge naphtha over a cobalt-molybdenum catalyst. Fig. 1.



OFFGAS BYPASS VALVE showing localized chloride corrosion. Fig. 2.

actors, but generally hydrogen damage has been avoided through the use of chromium and molybdenum steels for exposed parts and by adequate insulation of carbon steel.

Higher concentrations . . . The corrosion in the pretreating section, where higher hydrogen sulfide concentrations prevail because naphthas contained as much as 0.05% by weight of sulfur are handled, was controlled by extensive use of chromium-nickel stainless steels and calorized coatings.

A simplified flow diagram of a Socony Mobil catalytic reformer with a naphtha pretreater is shown in Fig. 1. This shows how excess hydrogen from reforming is used to desulfurize the charge naphtha over a cobalt-molybdenum catalyst.

Field Corrosion Tests

Coupon-test results in catalytic reformers with naphtha pretreaters have borne out predictions that desulfurization of the charge to below 0.002% by weight of sulfur would reduce high-temperature hydrogen sulfide corrosion of low-chromium steels used in the catalytic reforming sections to a negligible level. For example, coupon tests in one commercial reformer, summarized in Table 1, show that the corrosion of carbon and low-chromium steels in the reforming section is well below the 0.01 to 0.02-in. per year level where flaking scale would be expected.

This test was run during the initial year of operation, and the charge naphtha to the reforming section contained an average of 0.002% by weight of sulfur.

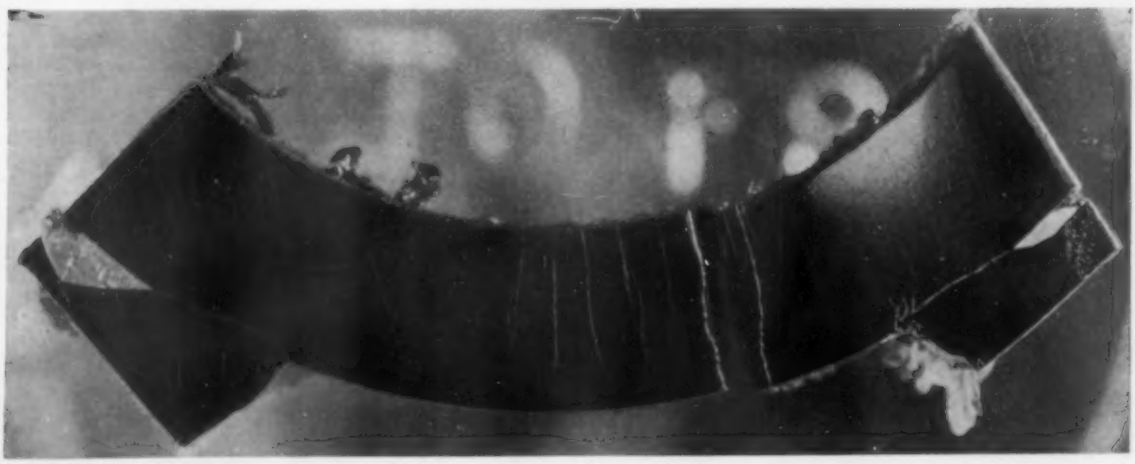
Test-coupon corrosion rates in the pretreating section are considerably higher than those in the reforming section. This is a result of the high hydrogen sulfide concentrations in the pretreating section. The test results shown in Table 1 for the reformer and the pretreater reactor inlets are in good agreement with published data.

Inspections have not revealed any high-temperature hydrogen sulfide attack in excess of that indicated by laboratory data or by coupon tests in the units. Corrosion has been negligible on calorized furnace tubes and transfer lines, and on chromium-nickel stainless steel used in the pretreating section for heater tubes, piping, reactor liners, and exchangers.

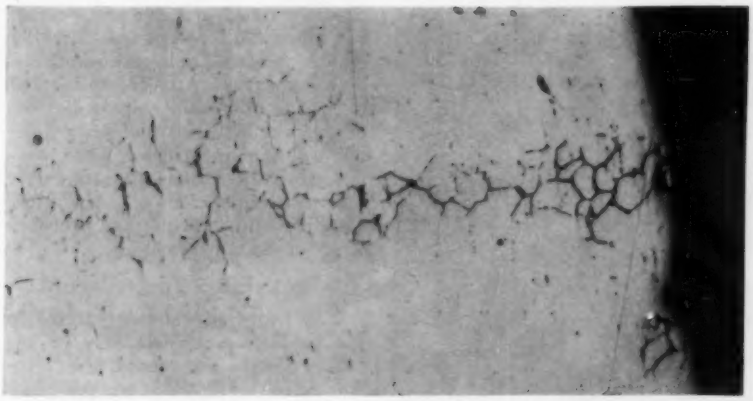
Pretreating . . . Sulfide scaling has generally been minimized in catalytic reformers with naphtha pretreaters, except in cases where desulfurization was inadequate because of pretreater operating difficulties. However, other types of corrosion have been experienced, chiefly in the pretreating sec-

TABLE 1—SUMMARY OF TEST-COUPON CORROSION RATES IN A COMMERCIAL REFORMER WITH A NAPHTHA PRETREATER

	Pretreating section		Reforming section	
Test-rack location—	Reactor inlet	Reactor outlet	No. 1 reactor inlet	No. 3 reactor outlet
Average conditions:				
Temperature, °F.	660	660	950	945
Pressure, psig.	480	460	615	535
Hydrogen sulfide, vol. %	0.048	0.11	0.0054	0.0055
Exposure time, days	344	344	344	344
	Corrosion rate (inches per year)			
Materials tested:				
0 to 9% chromium steels	0.015	0.0094	0.0017	0.0018
12 to 16% chromium steels	0.0028	0.0024	0.0007	0.0007
18-8 chromium-nickel steels	0.0008	0.0005	0.0001	0.0002



STRESS-CORROSION CRACKS in austenitic stainless steel are shown in this photo of a cross-section of a drain nozzle on a pretreater reactor effluent exchanger. Fig. 3.



PHOTOMICROGRAPH of sensitized stainless steel lining showing intergranular cracking due to carbide precipitation and attack of polythionic acids. Fig. 4.

tion, even in properly operating units.

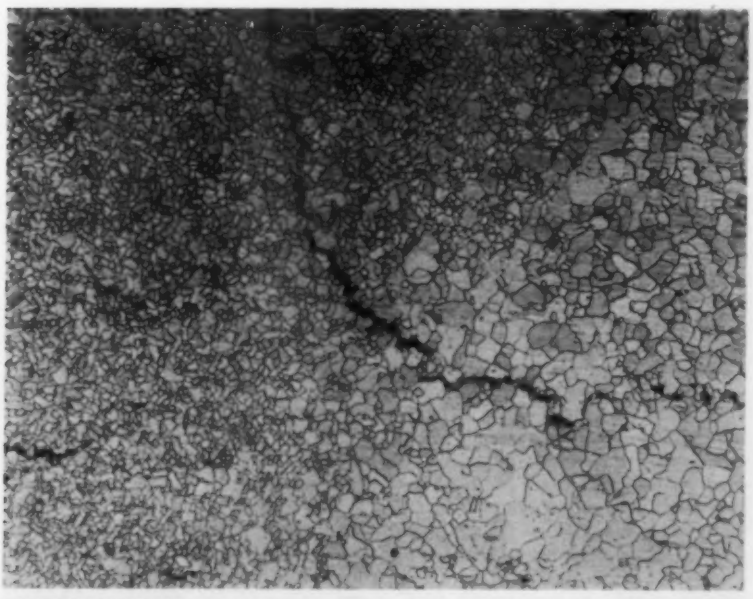
These corrosion problems have been more serious than the sulfur problem which was given consideration during the design of the unit. These problems stem from the fact that hydrogen used for pretreating the naphtha charge not only removes sulfur as hydrogen sulfide, but also produces hydrogen chloride and ammonia by the hydrogenation of organic chlorine and nitrogen compounds present in small quantities.

Hydrogen chloride, in the low-temperature sections of the unit and in the presence of the small amount of water in the naphtha, has caused corrosion of valve seats, tower trays, piping, and condensers. Ammonia and hydrogen chloride, as they pass through the effluent exchanger train, condense to form solid ammonium chloride deposits.

These deposits result in a serious fouling problem and contribute to the corrosion. This problem has occurred in several units operating on charge naphthas containing 0.03 to 0.05% by weight of sulfur, from 2 to 10 p.p.m. of chlorine, and from 1 to 5 p.p.m. of nitrogen.

At present, there are 14 catalytic reformers with naphtha pretreaters in operation and 2 more under construction. Five of these have started recently, and very little information is available on corrosion experiences.

Of the nine with operating experience up to approximately 3 years, there has been no difficulty, as a result of chloride corrosion, in four of them. Adequate provisions were made before startup of one of the units, leaving only four in which chloride corrosion has appeared as a problem during operation.



PHOTOMICROGRAPH of carbon-steel support ring showing complete decarburization and fissuring. Fig. 5.

Chloride Corrosion and Fouling

By its localized but severe nature, chloride corrosion has caused unscheduled shutdowns, periods of poor operation, and more maintenance than expected. An example of the nature of this localized corrosion is illustrated in Fig. 2. This photograph shows severe attack on the outlet of an offgas bypass valve which operated slightly open.

Corrosion occurred at the point where the cooling effect of gas expansion caused condensation. Penetration in this area caused a leak which necessitated a shutdown for repairs.

From an operational standpoint, ammonium chloride fouling is critical for several reasons. For one thing, the deposits may interfere with proper operation of valves and instruments. Also, the deposits cause excessive pressure drop and may limit unit throughput. In one 20,000-bbl. per day unit, the pressure across the pretreater effluent-exchanger train built up to 125 psi. after 3 months of operation.

The ammonium chloride which caused the fouling was removed by means of washing with boiler feed water. From analysis of the wash water, it was calculated that 750 lb. of ammonium chloride was removed. Because this quantity of ammonium chloride accumulated each month, the washing process had to be repeated at intervals.

In this same unit, localized chloride corrosion resulted in several exchanger-tube leaks which permitted bypassing of untreated naphtha around the pretreater reactor. This bypassing allowed the sulfur content of the charge to the reforming section to increase for a short time, to a point where high-temperature sulfide scaling might have become a problem.

Similar exchanger leaks resulting from chloride corrosion have occurred in other units. In one case, corrosion of valves on a spare pump manifold permitted bypassing of the reactor.

Stress-corrosion cracking of austenitic stainless steels is another problem which may be encountered as a result of the presence of chlorides. Normally, the austenitic stainless steel used in high-temperature sections to resist hydrogen sulfide corrosion is not subject to cracking under service conditions. During shutdowns, however, moist chlorides may promote stress corrosion of these materials with

A 90°-BEND TEST of the material shown in Fig. 5 proved it had but little ductility. Fig. 6.

residual stress from welding or cold working.

An example of a stress-corrosion failure is shown in Fig. 3. This is a photograph of the cross-section of a Type 304 drain nozzle on a pretreater reactor effluent exchanger. It will be noted that several radial cracks are revealed: two of them penetrated the wall completely; others reached 80% penetration. Microscopic examination revealed that the cracking was principally transgranular.

The specimen also exhibited intergranular carbide precipitation; a boiling copper sulfate-sulfuric acid test showed it to be sensitized. Transgranular cracking of a sensitized stainless steel is regarded as convincing evidence that chlorides were responsible for this failure.

Control of corrosion and fouling . . . Intermittent water washing is being used to combat severe ammonium chloride fouling. In many cases, it is practical to use onstream water washing. This is accomplished by injecting water at various points in the pretreater reactor effluent exchanger train, in which case the water is drawn off from the flash drum.

Also, water has been injected in the overhead vapor line of the stripper tower following the pretreater; this water is drawn off in the overhead accumulator. Whenever water injection is used, caution must be exercised to prevent moisture carryover into the reformer feed.

The addition of water alone could create an acid condition which would promote corrosion. To counteract this, ammonia is added where necessary to raise the pH of the drawoff water to 6.5 to 8.0.

Before water injection was used, it was found that the small quantities of water in the pretreating system often had a pH as low as 2.5. Injection of water, at a rate of 2 to 5 gal. per minute, into a 12,000-bbl. per day unit was found to raise the pH, through dilution, to the 4 to 6 range. At these pH's it was found, by analyzing the effluent water, that excessive quantities of metal were being removed.

Hence the practice of adding ammonia to the water was initiated. In a typical unit, 5 gal. per minute of water and 1.7 lb. per hour of ammonia are being injected to maintain the pH at 7 to 8. Under these conditions, the chloride content of the water drawn from the system is from 250 to 450 p.p.m., indicating removal of from 20 to 30 lb. of chlorides per day. Iron contents have been reduced from several thousand to less than 20 p.p.m.

Another method of reducing corrosion during water injection has been tried. Filming-type organic inhibitors have been injected experimentally, but they are not generally used because their emulsification properties tend to increase the moisture content of the reformer feed.

Localized chloride corrosion has been controlled in a number of cases by substituting Monel for steel in critical areas. Transgranular stress-corrosion cracking is being prevented by means of washing piping and exchangers with water and dilute alkaline solutions immediately after shutdowns. This treatment washes out most of the chlorides or other acidic materials, thus lessening the probability of stress corrosion.

HCl at High Temperatures

The hydrogen chloride formed in the naphtha pretreaters may be the reason for the unexpected low corrosion results observed at the pretreater reactor outlet. The corrosion rates at the pretreater outlet were less than at the inlet, even though the hydrogen sulfide concentration was more than twice as high at the outlet.

Prutton, Turnbull, and Dlouhy showed that the presence of hydrogen chloride will inhibit the growth of iron sulfide scale in a hydrogen sulfide atmosphere. In experiments conducted with 50-50 mixtures of hydrogen sulfide and hydrogen chloride at 595° to 660° F. for exposures of 5 to 60 minutes, these authors found that the iron chloride formation was slightly less than with hydrogen chloride alone; the iron sulfide formation was considerably less (one-third to one-tenth) than with hydrogen sulfide alone.

They concluded that although equilibrium conditions are favorable for the formation of iron sulfide at these temperatures, the iron chloride in the film inhibits the reaction of hydrogen sulfide with iron. When iron chloride and iron sulfide are forming simultaneously on the surface, no continuous film of iron sulfide exists.

Diffusion of iron ions from the metal surface to the gas-film interface through an iron sulfide layer can no longer take place because of the interposition of the poorly conducting iron chloride. Consequently, the number of iron ions and electrons reaching the gas-film interface will be much less, and the amount of iron sulfide formed will be correspondingly less.

We have attempted to check this observation experimentally in our own laboratory with the use of a hydrogen atmosphere. Simulated pretreating conditions were selected; relatively large amounts of hydrogen chloride were used in a hydrogen atmosphere at 750° F. containing 1.5 vol. % of hydrogen sulfide.

The results, summarized in Table 2, support the findings of Prutton et al., namely, that corrosion rates are lower when hydrogen chloride is present. Thus, in the presence of hydrogen chloride the corrosion rate for the

TABLE 2 — EFFECT OF HYDROGEN CHLORIDE ON HIGH-TEMPERATURE HYDROGEN-HYDROGEN SULFIDE CORROSION

Laboratory test run—	A	B*	C
Average conditions:			
Hydrogen chloride, vol. %	0	0.38	0.75
Temperature, °F.	730 to 760	730 to 760	730 to 760
Total hydrogen pressure, psig.	485	485	485
Hydrogen sulfide, vol. %	1.5	1.5	1.5
Length of test, hours	275 to 500	275 to 500	275 to 500
	(Corrosion rate (inches per year))		
Materials tested:			
0 to 9% chromium steels	0.115	0.036	0.040
18-8 chromium-nickel steels	0.0096	0.0068	—0.0076
25-12 chromium-nickel steels	0.0054	0.0046	0.0051

*The average temperature in run B was approximately 10° F. less than in run C.

carbon and low-chromium steels was lowered more than 60%, the rate for 18-8 chromium-nickel stainless steels was 20% lower, but very little change in rate was noted for the Type 309 stainless steel.

Intergranular cracking . . . Whenever austenitic chromium-nickel stainless steels have been employed in commercial units for resisting high-temperature hydrogen sulfide attack, the general practice has been to use titanium or columbium-stabilized grades for welded construction. These stabilized grades have been selected because of their resistance to intergranular attack.

According to Dravnieks and Samans, the action of wet steam on iron sulfide produces polythionic acids which may attack grain boundaries of sensitized stainless steel and cause intergranular cracking. An additional precaution, aimed at preventing moist steam from condensing on stainless steel after it has been exposed to sulfide environment, has been established for shutdown procedures.

Generally these measures have been successful. In one case, however, extensive cracking of a stainless-steel pretreater-reactor lining occurred after steam was injected into the reactor to snuff a fire at the top of the catalyst bed during a scheduled shutdown. Most of the lining material consisted of titanium-stabilized stainless steel which had been applied to the shell by submerged-arc welding with an unstabilized filler wire.

One plate of an unstabilized chromium-nickel steel had also been used during fabrication. Cracking was confined entirely to the unstabilized welds and plate. The intergranular cracking of this plate is illustrated by the micrograph in Fig. 4.

High-Temperature Hydrogen Attack

Generally, high-temperature hydrogen damage has been avoided in both the pretreating and reforming sections through the use of austenitic stainless, chromium, and molybdenum steels. Carbon-steel reactor vessels with adequate internal insulation have also been used and proved satisfactory; in some cases, however, external cooling has been required to reduce excessive local temperatures resulting from internal insulation failures.

Carbon-steel reactor internals used in a few cases have not proved satisfactory; hydrogen attack in the form of blistering, decarburization, fissuring, and embrittlement has been observed. These failures, however, were not serious.

The only serious failure involved the use of a carbon-steel support ring for a stainless-steel shroud. Insulation around this support ring proved to be inadequate, and hydrogen attack caused deterioration of the carbon steel. This support cracked and pulled away from the shell, causing a break in the insulation which permitted hot vapor to impinge on the reactor shell.

Detection of local high temperatures on the shell warned of this condition, and corrections were made before any permanent damage to the shell resulted. Fig. 5 is a photomicrograph of the steel in the support ring which shows complete decarburization and fissuring. A 90°-bend test proved this material had little ductility, as can be seen in Fig. 6.

Corrosion deposits . . . In one unit, after 10 months of operation, a fairly thorough survey was made of the corrosion deposits found throughout the unit. Analytical methods employed were X-ray diffraction, emission spectroscopy, and quantitative wet analysis. As expected, the main deposit in the pretreating section was iron sulfide. No appreciable quantity of ammonium chloride was found in this section because the unit was thoroughly water-washed before being opened for inspection.

In the high-temperature reforming section the main deposits were iron or iron oxide (Fe_3O_4). The oxide was formed during the mild regeneration employed before the unit was opened for inspection. The iron deposits undoubtedly came from the reduction of iron sulfide scale by hydrogen.

This unit had a history, for a short period, of high hydrogen sulfide concentrations in the reformer as a result of operational difficulties of the pretreater; later there followed an extended period of effective desulfurization which lowered the hydrogen sulfide in the reforming section to a point where the sulfidic corrosion mechanism was reversed.

In the low-temperature reformer sections, particularly in the recycle gas compressor, the main deposits were chloride compounds. Crystalline hydrated ferrous chlorides ($FeCl_2.2H_2O$ and $FeCl_2.4H_2O$) were prominent among the compounds definitely identified.

"I bet I'll remember the NEXT API meeting!"

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The old and the new in flares—elevated and multijet.

No smoke, no light, no noise . . . that's the claim made for a new flare. And it needs no auxiliary utilities to make it smokeless.

BY P. D. MILLER, JR., H. J. HIBSHMAN, AND J. R. CONNELL

A NEW FLARE, called the multijet, promises an economical solution to most flaring problems. Developed by Esso Research & Engineering Co., one installation has been in service for more than a year, and several others are being designed.

Authors Miller and Hibshman are with Esso Research & Engineering Co. Connell is with Imperial Oil, Ltd. Paper presented at API division of refining annual meeting, Los Angeles, May 12-15, 1958, under the original title "The Design of Smokeless, Nonluminous Flares."

The flare provides completely smokeless and noiseless burning, and its light is shielded by a 32-ft. stack. The flare requires no auxiliary utilities, such as steam or water, to make it smokeless.

The multijet is usually sized to be smokeless and nonluminous for at least 95% of the expected occurrences of flaring.

The flare stack is a steel shell lined with refractory material; the base of the flare is several feet above grade and contains one or more rows of multijet burners.

The multijet burners are of simple design. They consist of a series of parallel pipes, or "burner lines," which traverse the bottom of the stack; each burner line contains a row of small nozzles discharging vertically into the stack.

Solid rods of refractory material are mounted above and parallel to the burner lines. The flared gases impinge against this rod, or "flameholder," before they reach the ignition zone. During this period, enough air is mixed with the gas to give smokeless combustion.

Development . . . The basic principles used in the design of multijets are quite simple. A large amount of earlier experimental work on the mechanism of combustion has shown that mixing of the fuel gas and air, rather than chemical reaction rates, usually controls the type of burning.

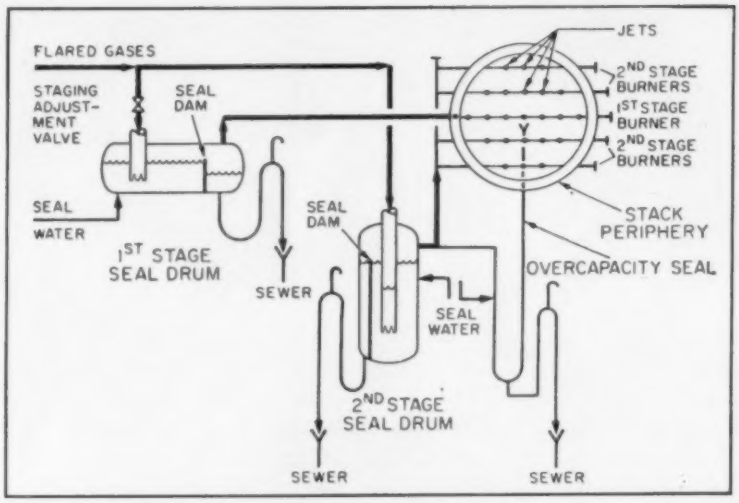
Accordingly, the clean burning of gas is primarily a matter of mixing sufficient air with the gas at a rate fast enough to minimize the formation of carbon; and to burn the carbon that is formed before it can agglomerate and leave the flame in the form of soot.

Past studies of turbulent flames, formed by jets of gas discharging into the air, have shown that the length of the flame is roughly 80 times the diameter of the gas jet and is relatively independent of jet velocity. It is apparent, then, that, at constant gas-jet velocity, smaller jet diameters will result in shorter times in which mixing and combustion are completed. Therefore, shorter and less smoky flames are to be expected as jet size is reduced.

Open Air Tests

First, single jets were tested to establish upper limits on the diameter. Half-inch and 1-in.-diameter jets were reasonably satisfactory. However, a 2-in.-diameter jet (operating at about 75 ft. per second) resulted in a large and fairly smoky flame. When the same amount of gas was burned in nine ½-in.-diameter jets, short, smokeless flames resulted.

The effect of spacing was studied with nine ½-in.-diameter jets. Jet spacings of 9 in., 15 in., and 27 in. were used with a square layout (jets located on a checkerboard pattern). The 15-in. spacing was satisfactory; 9 in. was too close (smoked); and 27 in. showed no significant improvement over 15 in.



FLOW DIAGRAM of multijet flare. The flare uses two burners, a small one for normal leakage and small blows, while both are active at higher flaring rates. Fig. 2.

These positive results were encouraging and permitted sizing an experimental stack with a fair degree of confidence. The chief purpose of the stack is, of course, to obscure the flame.

Confined Tests

Two stacks were tested: one was 3 ft. in diameter, the other was 6 ft. Both stacks are 32 ft. high and mounted 5 ft. off the ground. They were constructed of ⅛-in. sheet steel. The 5-ft. space below the bottom of the stack proved to be adequate to admit an excess of combustion air.

In general, the stack lengthens the flame and, by enhancing draft, tends to produce less stable flames. However, it reduces the tendency of wind to blow the flames out or to cause smoke. The burner was constructed from standard pipe fittings and was assembled essentially along the geometric pattern described later for the commercial unit.

Flameholder development . . . It was immediately apparent that unless the burner were 2 ft. or more below the stack, the stack draft would lift the flame off the burner and put it out. Standard 3½-in.-diameter flanges mounted on the ends of the jets were inadequate as shields. Although they tended to prevent blowout when the burner was in the stack, the flames were quenched when the burner was located in the preferable position below the stack.

Satisfactory flameholding and initial propagation of flame from one jet to another were finally achieved by installing horizontal pipes across the burner a short distance (0.5 to 1.0 in.) above the ports. End plates on these "flameholders" minimized the effect of wind on the end jets. This method of flameholding was used in all subsequent experiments.

Position of burner . . . On both stacks, it was found desirable to place the burner below, rather than within, the stack. Placing the burner below the stack increased both the maximum capacity and the turndown ratio of the flare. (Turndown ratio is the ratio of maximum to minimum satisfactory flaring rate.)

With the 6-ft. stack, turndown ratio was about 2 when the burner ports were 6 in. above the bottom of the stack. When the burner was placed 6.5 in. below the stack, turndown ratio improved to 10.

Flaring rate . . . Up to 140 M.s.c.f. per day was burned in the 3-ft. stack without flames showing at the top. In the 6-ft. stack, a similar burner produced a flame 25 ft. long at 600 M.s.c.f per day (2.21 million B.t.u.'s per hour per sq. ft. of stack cross-section).

On the basis of stack cross-sectional area, these two rates are essentially equal. It appears, then, that the limiting gas rate per unit area is not affected by stack diameter.

Three combinations of jet diameter were tried:

1. One-half inch jets with ½-in. flameholders.
2. One-inch jets with ½-in. flameholders.
3. One-inch jet with 1-in. flameholders.

The third combination was best.

Flue-gas samples . . . Taken at the top of the 6-ft.-diameter stack indicated that combustion is quite complete. Although there was some nonuniformity of composition across the stack, the analyses showed an average of 165% excess air.

Commercial Operation

Imperial Oil's Halifax refinery afforded the first opportunity for commercial installation of the new flare. The refinery was already equipped with an elevated flare which would continue in service as a major emergency flare. The multijet was needed to handle the more frequent, smaller emergencies and to dispose of any net surplus of refinery fuel gas.

The flare design capacity was set at 2.1 M.M.s.c.f per day of a 40 mol. wt. gas, or about 200 million B.t.u.'s per hour. The burner design, which will be described later, is essentially a scaleup of the pilot-plant burner.

Fig. 1 is a photograph of the two flares taken about a year ago. The multijet's stack has an inside diameter of 12 ft. and is 32 ft. high. The bottom of the stack, which is 6 ft. above the ground, is protected by an 8-ft.-high shield, or "windbreaker."

Fig. 1 also shows a view of the mulitjet. (The windbreaker shown in the photograph is a temporary construction; the original louvered windbreaker was destroyed by a storm.)

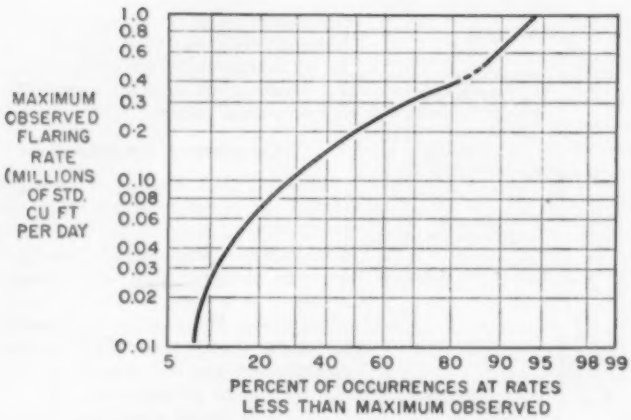
The burner piping and jet grid are positioned several inches below the bottom of the stack. The stack is lined with two courses of firebrick, providing a total insulation thickness of 9.4 in.

The first design of the louvered windbreaker proved to be an inadequate shield against light. There was insufficient overlap of the blinds to prevent line-of-sight vision to the bottom of the stack, causing appreciable ground-glow at night. Inasmuch as the temporary solid shield seems to cause undesirable wind eddies, it will be replaced with an improved louvered type of shield.

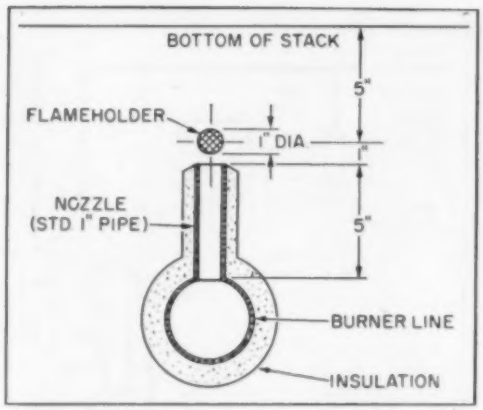
The first flameholders were solid, fused alumina rods; these rapidly deteriorated and were replaced with silicon carbide. No further difficulties with the flameholders have been reported.

Costs . . . Table 1 compares the costs of several types of flares. When permitted by local conditions, the simple elevated flare is always the first choice. But when it is necessary to minimize smoke, an elevated flare quickly loses its advantage.

The initial cost of the new steam facilities for the flare is more than three times the cost of the flare itself. In special cases where steam can be temporarily diverted from noncritical



TYPICAL INCIDENCE and rates of flaring. Fig. 3.



CRITICAL DIMENSIONS of burner assembly. Fig. 5.

consumers, such as tank heating, the use of steam injection becomes more attractive.

The cost of a ground flare with water injection is considerably less than that of an elevated flare with independent steam supply. But the ground flare with water injection only eliminates smoke, not visible flame. Because the installation cost of the multijet is essentially the same as that of a ground flare, the multijet becomes the first choice.

Fig. 2 is a simplified flow diagram for a typical multijet. The flare uses two burners; a small burner handles normal leakage and small blows, while both burners are active at higher flaring rates. This "staging" is controlled by two water-seal drums set to release at different pressure levels.

A third emergency release is provided in the center of the stack, bypassing the multijet burners. The water seal to this release will blow at flaring rates higher than the design capacity of the flare. When the overcapacity seal has been blown, the flare is, of course, both luminous and smoky.

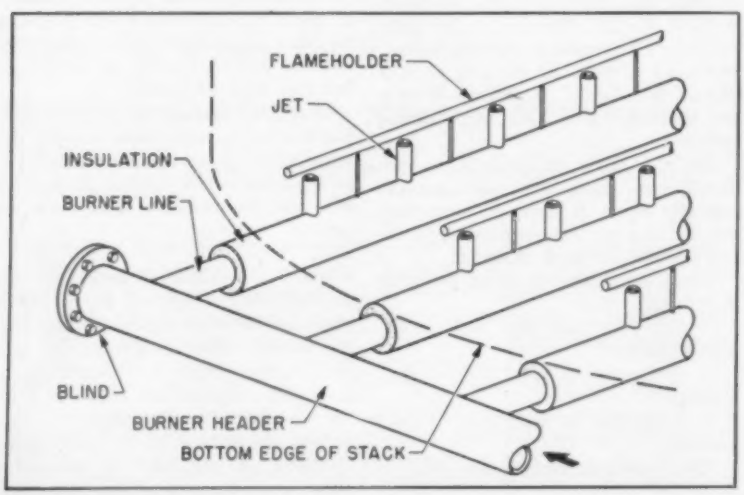
But the unit is usually sized so that an overcapacity blow would be a rare occurrence. The overcapacity line may also discharge to an elevated flare rather than to the center of the multijet stack.

Similar staging could be accomplished with automatic valves or back-pressure regulators. However, our practice is to avoid using automatic instrumentation in safety equipment. The extra price paid for the drums is more than offset by their reliability and ease of maintenance.

The staging system is balanced by adjusting the hand-controlled butterfly valve leading to the first-stage drum. After its initial setting, this valve is locked into position.

TABLE 1—TYPICAL FLARE COSTS

Type of flame—	Onsite	Offsite	Total
Elevated, no steam	$ 66,000	$ 3,000	$ 69,000
Elevated, with steam	66,000	225,000	291,000
Ground, with water	102,000	44,000	146,000
Multijet	145,000	3,000	148,000



BURNER ASSEMBLY of multijet flare. Burner lines are connected just outside stack to a large header. Fig. 4.

Basis for sizing . . . The most difficult task is to estimate the optimum design capacity of the flare. It is easy enough to determine the maximum possible release from certain groups of processing units, but this maximum release would usually occur so rarely that it would not be economical to size the flare on this basis.

Fig. 3 shows a record of the incidence of flaring from a certain group of units over a year's time. The maximum flaring rate from these units is not shown on the graph, but on several occasions it approached 15 to 20 M.M.s.c.f. per day. However, the graph shows that a flare sized for 0.2 M.M.s.c.f per day would handle 50% of the flaring, and one sized for 1.0 million would handle 95% of the flaring.

When data such as these are available, it is easy enough to make a decision. A flare for this group of units would be sized for 1.0 M.M.s.c.f. per day, having an overcapacity line (or elevated flare) sized for 20 M.M.s.c.f. per day.

We have no magic formula for predicting average flaring rates for new units. This is largely a matter of experience and judgment, while keeping in mind the type of process, the pressure levels, the number of safety valves, and the maximum possible release.

Stack dimensions . . . The inside diameter of the stack is based on the

One of Claymont's multi-torch automatic flame-cutters. *by d'Arazien*

Main feature of the Claymont story is integration. For instance, consider one phase of our operation—the new Fabrication Shop. First, steel from Claymont's own open hearth is formed into plate on Claymont's own rolling mills and sent to the Fabrication Shop. Here, modern equipment welds, shears, presses, rolls, cuts or machines the plate to produce fabricated products for many industries.

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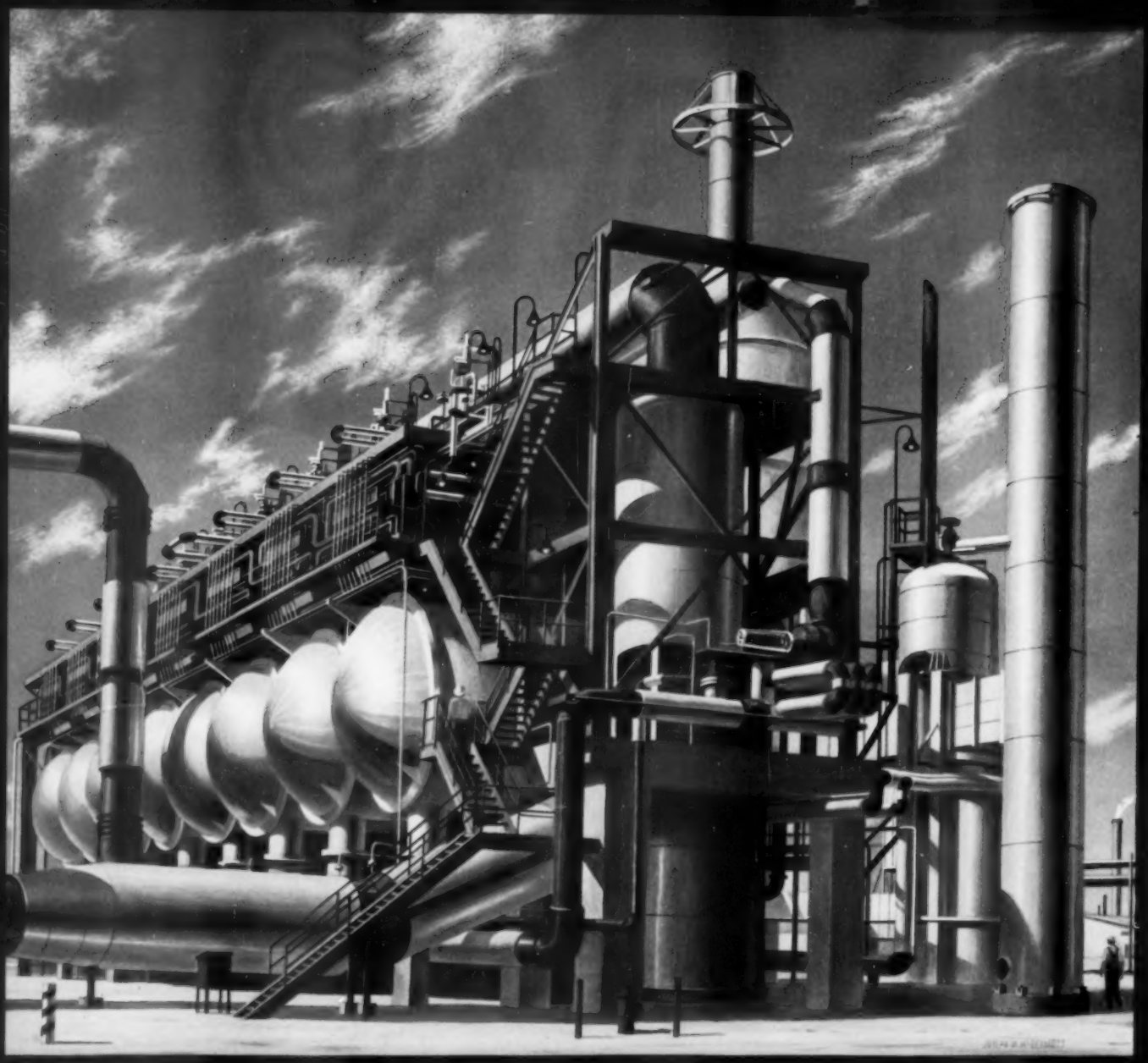


BUTANE TO BUTADIENE IN A SINGLE STEP

The Odessa Butadiene Company at Odessa, Texas, uses the flexible, single-step Houdry Dehydrogenation Process and Houdry Chrome-alumina Catalyst to produce butadiene from butane. This installation of 50,000 tons per year butadiene design capacity could be adapted to the single-step conversion of other light paraffins, or paraffin-olefin mixtures, to olefins and diolefins.

Look into the economy of the Houdry Dehydrogenation Process, using process-proved Houdry Chrome-alumina Catalyst. Houdry Process Corporation, 1528 Walnut Street, Philadelphia 2, Pa.

HOUDRY
PROCESSES
*Houdry means Progress . . . through Catalysis

rate of heat release at design capacity. Currently, we use 535 sq. ft. of stack cross-sectional area per million B.t.u.'s per hour. As an equation,

$$D = 0.828Q^{0.5} \quad (1)$$

Where:

D = stack inside diameter, feet.
Q = heat release, millions of B.t.u.'s per hour (based on high heating value).

The vertical length of the stack, i.e., vertical length of the stack vs. height of the top of the stack aboveground, is independent of the diameter and is usually made 32 ft. The bottom of the stack is above grade; the minimum clearance between grade and the bottom of the stack is either one-fourth of the stack inside diameter or 6 ft., whichever is greater.

The steel shell of the stack is lined for its entire length with 4 to 6 in. of refractory and insulating material.

The multijet burner has a turndown ratio of approximately 10:1. A two-stage burner will give a maximum turndown ratio of 100:1—which is adequate for most situations. When designing for two stages, we usually let the first stage handle approximately 20% of the total maximum load.

Although this reduces the over-all turndown ratio to approximately 50:1, it will permit a reasonably large flaring rate without blowing both water seals. It also provides a large overlap between the maximum burning rate of the first stage and the minimum rate of the second stage. This is desirable for smooth operation.

Number of jets . . . The jet nozzles are made from standard 1-in. pipe; each nozzle is 5 in. long. The jets discharge vertically from subheaders, or burner lines, which run horizontally across the bottom of the stack. The burner lines are connected just outside the stack to a large header. This arrangement is shown in Fig. 4.

For design rates up to 12 M.M.s.c.f. per day, the burner lines are usually specified as 6-in. pipe. The common header on the second-stage burner would be approximately 18-in. pipe.

The number of jets is based on gas velocity. For 1-in. standard pipe, the recommended velocity permits a flow rate of 61.2 M.s.c.f per day per jet. Expressed as an equation,

$$N = 16.4V \quad (2)$$

Where:

N = number of jets.
V = flare design capacity, millions of standard cubic feet per day (for a flare system, standard cubic feet is almost always equivalent to actual cubic feet).

The jets are on a square or rectangular layout with a pitch of 18 to 24 in. A first estimate of the required pitch can be obtained from the following:

$$P_s = 10\ D/N^{0.5} \text{ (for square layout)} \quad (3)$$

$$P_s = 100\ D^2/NC \text{ (for rectangular layout)} \quad (4)$$

Where:

P_s = jet pitch, inches.
D = stack inside diameter, feet.
N = number of jets.
C = distance between center lines of burner lines, inches.

No jets should be placed closer than 12 in. to the inside of the stack. For gases with low heating values, it is usually preferable to decrease the jet pitch to less than 18 in. to avoid an increase in the stack inside diameter. It is preferable to keep the pitch above 15 in.

Flameholders . . . The flameholders actually are the most important feature of the flare. They are solid 1-in. diameter rods of refractory material running horizontally above each burner line. The rod is positioned directly over the jet nozzles, with the bottom of the rod ½ in. above the tips of the nozzles.

The rods provide a surface at which burning can take place, preventing the flame from riding up to the top of the stack. The flameholders also promote better mixing of air and gas by the additional turbulence which they cause above the jets.

The entire burner assembly—except for the flameholders—should be insulated to withstand direct flame impingement.

The position of the flameholders and burner lines relative to the bottom of the stack is critical for proper operation. These dimensions are shown in Fig. 5.

So far, all of our multijet designs have included provisions for field adjustment (±2 in.) of the distance between the top of the burner lines and the bottom of the stack. This is done with variable-length pipe hangers and a relatively long main header.

The burner lines should all lie in an absolutely horizontal plane below the stack. The main headers are sloped back to the seal drums to provide drainage.

One or two pilot burners are provided at each end of the first-stage burner line. These burners are recessed into the wall of the stack and directed over the nearest jet. Most of our designs include both an oil-fired and a gas-fired pilot at one end of the burner line to insure an active pilot at all times.

Windbreaker . . . The recommended windbreaker is an octagonal louvered fence placed approximately 8 ft. from the stack, and extending to a height approximately 2 ft. above the bottom of the stack. The construction is somewhat like a venetian blind.

This avoids line-of-sight vision to the bottom of the stack, while permitting the entrance of combustion air. The slats are approximately 6 in. wide with at least 2 in. of overlap. They are sloped at a 45° angle to direct the flow of air downward on the inside of the enclosure. As a safety precaution, there are four access doors in the windbreaker.

The stack and the windbreaker stand over a slightly concave, concrete pad. Drainage is provided from the center of the pad to a sealed catch basin.

The seal drums provide protection against flashback into the blowdown lines. They also make it possible to set up a simple staging system for the burners.

The drums are sized on two criteria:

1. The water holdup should be sufficient to provide a 10-ft. slug of water in the inlet line to the drum in the event of an explosion downstream of the drum.

2. To avoid excessive entrainment, the vapor velocity in the drum should not exceed that given by the following equation:

$$v = 0.267\ [(d_L - d_g)/d_g]^{0.5} \quad (5)$$

where:

v = allowable vapor velocity, ft. per second
d_L = density of entrained liquid, lb. per cu. ft.
d_g = density of vapor, lb. per cu. ft.

A seal dam is provided in each drum to prevent the burner back pressure from varying the seal level. This is shown in Fig. 3. The seal loops from the drum to the sewer should provide a seal depth of at least 10 ft. Each drum is provided with a seal water rate of approximately 20 gal. per minute.

The submerged ends of the inlet lines to the drums are notched to prevent cyclic release of the gas which accumulates from normal leakage.

ETHYL RESEARCH APPRAISES VOLATILITY PROBLEMS OF FUTURE FUELS

Another important phase of octane improvement cost studies which must be balanced with engine requirements

Volatility cannot be separated from octane improvement cost studies of present day and future fuels. Exactly how much effect volatility will have upon cost studies will depend upon the individual refining situation and the value and/or availability of various pressurizing materials.

Studies in this field show that volatility is frequently a limiting factor in fuel composition.

Volatility and Engine Appetite

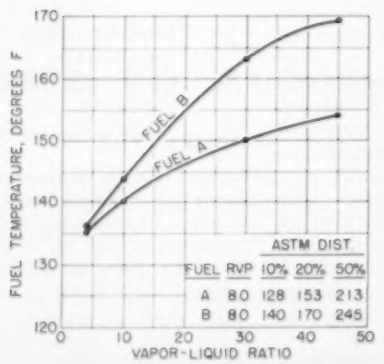
The importance of volatility as it relates to cost of octane improvement cannot be minimized. Yet engine acceptance of proposed volatility specifications must be given careful consideration. This is not always a straightforward comparison with previously marketed products.

Studies of refining trends made by Ethyl engineers indicate that volatility control of future fuels may become a subject for very careful appraisal as it relates to satisfactory engine performance.

Refining Trend— To More Aromatics

The refining trend within the next few years is toward higher aromatic fuels. Refinery practices such as splitting reformate, extraction of aromatics, and allocating more feed to the reformer all will be contributing factors. As more aromatics are blended to gasoline, there is an attendant decrease of mid-volatility

FIG. 1
EFFECT OF ASTM DISTILLATION ON THE VAPOR-FORMING CHARACTERISTICS OF GASOLINE



FUEL	RVP	ASTM DIST. 10%	20%	50%
A	80	128	153	213
B	80	140	170	245

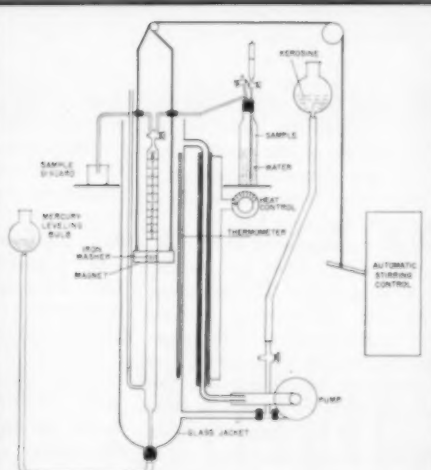
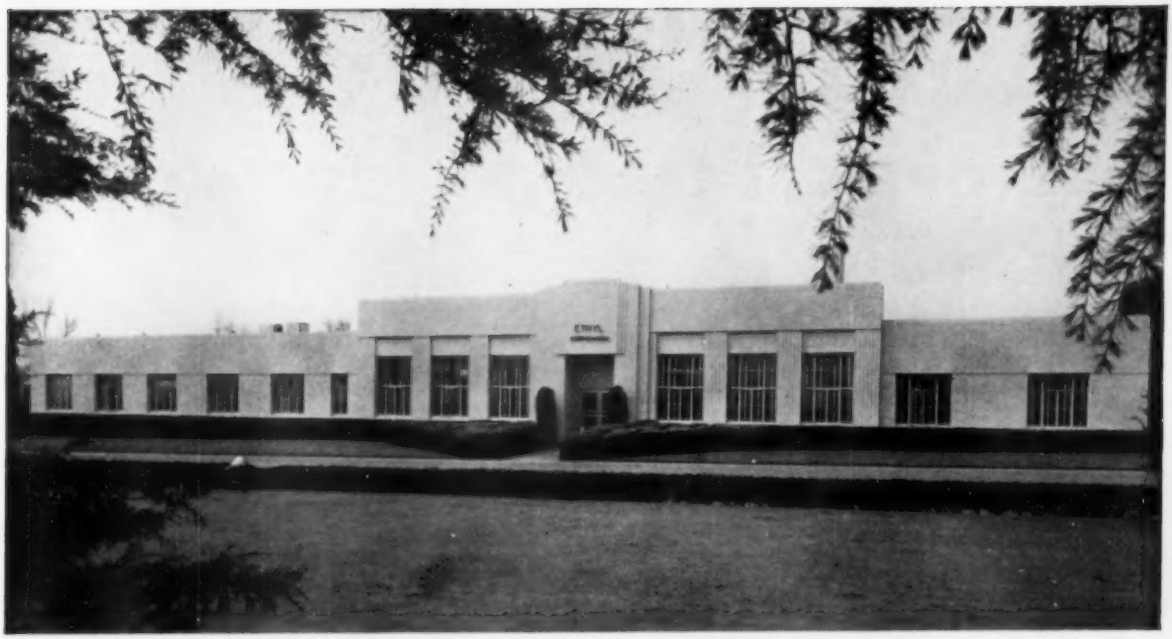


FIG. 2 Apparatus for measuring the volume of gasoline vapor at various temperatures.



ETHYL'S SAN BERNARDINO LABORATORY is ideally situated and well equipped for general studies of fuel volatility. Maximum daytime temperatures near 100°F. prevail throughout the long summers. Suitable test roads are available at various altitudes.

as shown by the ASTM distillation curve.

Ethyl experience has shown that this frequently will hamper warm-up characteristics of today's engines. *Warm-up* has been given very careful consideration in Ethyl fuel studies since this is a vital aspect of mid-volatility.

Very often mid-volatility problems will require complete rebuilding of the fuel with maximum use of light blending components such as iso-pentane.

Precautions with Iso-Pentane

From the standpoint of engine acceptance, iso-pentane must be carefully appraised. Vapor lock is probably the most important single factor that must be considered. Vapor formation proceeds at a very rapid rate in fuels that are pressurized with large quantities of less volatile pentane, once designed-for fuel temperatures are exceeded.

An evaluation must be made for any volatility change. However, more care must be exercised in the control of a pentane-pressurized fuel than one adjusted with butane since more severe vapor locking difficulties can result during unseasonably hot weather.

Can Vapor Lock Tendencies Be Estimated?

The rates of vapor formation at various temperatures determine the relative vapor locking tendencies of gasolines. Vapor formation is not necessarily related to Reid vapor pressure alone.

One method of arriving at this information is shown in Fig. 1. Two fuels of the same Reid vapor pressure but different ASTM distillation curves are indicated. Fuel A produced 30 volumes of vapor per volume of liquid at 150°F., whereas Fuel B formed only 16 volumes at the same temperature.

The above type information (temperature V/L values) may be calculated from usual gasoline inspection data using Coordinating Research Council procedures.

Experience may then relate the temperature—V/L values to vapor locking tendencies of cars under seasonal conditions for the area of interest. Such an appraisal permits a more accurate specification of desired front-end volatility.

Frequently it is necessary to cross-check temperature V/L values of fuels having unusual distillation characteristics by an experimental procedure. Apparatus for such laboratory work is described in Fig. 2. This equipment is available at the San Bernardino branch of Ethyl Corporation's Research Laboratories.

Other facilities there include a gasoline testing laboratory, and a chassis dynamometer which operates under controlled temperature, wind and velocity conditions. Ethyl Technical personnel have frequently used these facilities in cooperation with refiners for studies of their gasoline volatility problems.

HOW ETHYL RESEARCH IS HELPING YOU

The Refining Industry is constantly studying volatility of future fuels as it relates to octane improvement.

Ethyl Corporation Refinery Technologists have recently made a precise study of butane and pentane to establish the octane blending values of these pressurizing agents in several refinery stocks.

Refining trends indicate that iso-pentane will find a position in future fuels for octane improvement and volatility control. Future fuel volatility should be carefully appraised from the standpoint of engine acceptance. Assistance in such studies, based on over 30 years' experience in fuel-engine relationships, is available from Ethyl's Research Laboratories.

For further information, just call your Ethyl Representative.

ETHYL CORPORATION
New York 17, N. Y.

ETHYL ANTIKNOCK COMPOUND — ETHYL CORPORATION

RESEARCH LABORATORIES:
1600 W. Eight Mile Road, Ferndale 20, Mich.
2600 Cajon Road, San Bernardino, Calif.

How hydrogenation acts to

Improve cat cracking feed stocks

The price tag:

Capital cost—$100 to $200 per daily barrel of capacity

Operating cost—normally less than 10 cents per barrel of feed

BY M. D. ABBOTT, R. C. ARCHIBALD
AND R. W. DORN
Shell Development Co.

HYDROTREATING of catalytic cracking feed stocks not only reduces the sulfur and nitrogen contents of the oil, but, under suitable conditions, converts a large proportion of the condensed polyaromatic compounds to monoaromatics.

Inasmuch as the polyaromatic nuclei crack only with great difficulty and then give rise to excessive coke, while monoaromatics lead to aromatic gasoline components, hydrogenation of catalytic cracker feed benefits both the yield structure and product distribution resulting from catalytic cracking.

An added benefit of hydrogenation is the removal of metallic contaminants of the oil which would tend to deactivate the cracking catalyst; in commercial operation accumulation of these metals has had no deleterious effect on the hydrogenation catalyst.

Laboratory and pilot-plant catalytic cracking of a variety of hydrogenated feed stocks shows that as a result of hydrogenation:

- Coke yields are decreased by as much as 65%.
- Gasoline yields increased by up to 20%.
- At the same time, sulfur and nitrogen are reduced to low levels, and the octane numbers of the gasoline are improved.

Commercial operations by Shell Oil Co. of Canada, Ltd., have given results in good agreement with the laboratory data.

Hydrogenation Experiments

Laboratory and pilot-plant hydrogenations were made by use of the Shell "trickle" technique,[15] in which gas rates are low so that a large part of the feed remains in the liquid state as it passes downward over the catalyst. In this way, advantage is taken of the washing action of the flowing oil to carry away materials deleterious to long catalyst life.

The range of other operating conditions studied includes: pressure, 500 to 3,000 psig.; temperature, 600° to 800° F.; and liquid hourly space velocity, in volumes of oil per hour per volume of catalyst, 0.25 to 5.

Catalysts . . . Many different catalysts were employed. Included were unsupported nickel-tungsten sulfide; and alumina-supported catalysts containing various combinations and concentrations of cobalt, nickel, molybdenum, and tungsten.

Two supported catalysts—one containing nickel, tungsten, and molybdenum,[11] and the other containing nickel and molybdenum[12]—were among the most active catalysts tested. In addition, the materials cost for the supported nickel-molybdenum catalyst was less than for the more common alumina - supported cobalt - molybdenum catalysts containing equal weights of active metals.

Polyaromatics hydrogenation . . . Polyaromatic hydrocarbons are undesirable components in catalytic cracking stocks because they are difficult to crack, form a disproportionate amount of coke, and contribute little to the important product yields. On the other hand, when hydrogenated to monoaromatic or naphthenic compounds, their catalytic cracking properties are very good.

In a typical flashed distillate from West Texas crude oil, polyaromatics are present in concentrations of 15 to 20 mole %; in a recycle gas oil, they are present in concentrations of 30 to 35 mole %.

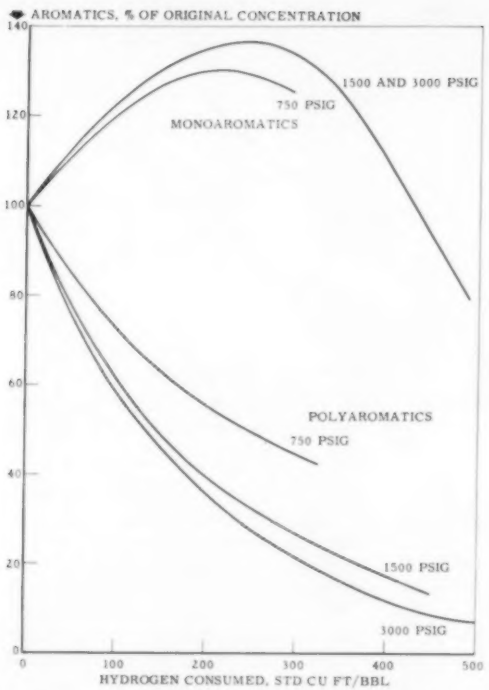
Polyaromatic hydrocarbons can be hydrogenated under a variety of pressures, e.g., from 750 psig. to 3,000 psig. or higher. Two observations have been made which influence the choice of hydrogenation pressure within such a range: (1) In general, the hydrogenation rate is greatest at the highest pressure; and (2) there is an equilibrium between polyaromatics and their hydrogenated products which is more favorable at high pressures. Thus use of high pressure greatly favors polyaromatics hydrogenation.

Fig. 1 displays the mono and polyaromatics contents of a low-sulfur West Texas flashed distillate after hydrogenation to various degrees. At the lower hydrogen consumption, polyaromatics are hydrogenated to monoaromatics more rapidly than the latter are saturated. Thus the monoaromatics concentration increases to a point where equilibrium between poly and monoaromatics is established.

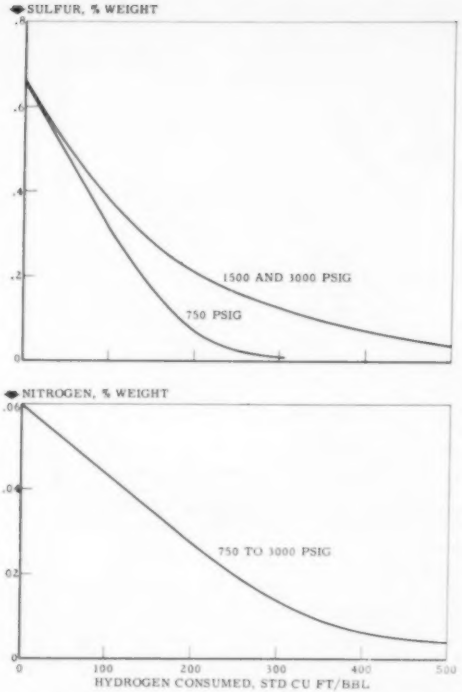
Following this maximum in the monoaromatics curve, the equilibrium is maintained and both poly and monoaromatics disappear at a rate corresponding to the rate of saturation of monoaromatics. Of course, the equilibrium concentrations and the rates vary with hydrogen pressure, and it will be observed that the reduction of polyaromatics is greater at higher pressures for a given hydrogen consumption.

Sulfur and nitrogen removal . . . During the hydrogenation of aromatics, heteroatoms, such as sulfur and nitrogen, are removed. This is illustrated in Fig. 2, which shows that sulfur is more easily removed than nitrogen. In general, excellent desulfurization and nitrogen removal are achieved under the conditions for polyaromatics hydrogenation, and this can be even fur-

Paper presented at API division of refining annual meeting, Los Angeles, May 12-15, 1958, under the original title, "Improvement of Catalytic Cracking Feed Stocks by Hydrogenation."



AROMATICS CONTENT of hydrogenated low-sulfur West Texas flashed distillate. Fig. 1.



SULFUR AND NITROGEN CONTENT of hydrogenated low-sulfur West Texas flashed distillate. Fig. 2.

ther improved by using higher temperatures.

Under such conditions, however, the polyaromatics hydrogenation is lower as a result of the equilibrium mentioned previously.

The destination of hydrogen during such a process is illustrated in Fig. 3. This shows the difference in utilization of hydrogen under low and high-pressure conditions. For a constant hydrogen consumption, reduction of sulfur plus nitrogen is favored at low pressure and polyaromatics reduction is favored at high pressure.

Metals removal . . . Heavy metals, commonly found in catalytic cracking feed, have long been known to have a detrimental effect on cracking yields. When these metals accumulate on the cracking catalyst, an increase in coke yield and a decrease in gasoline yield normally follow.

Passage over a hydrogenation catalyst is an effective means for removing these metals from the cracking-unit feed. Table 1 shows that mild hydrogenation of both West Texas and Kuwait flashed distillates results in rejection of 80 to 95% of the metals.

Hydrogenation yields . . . For certain specific feed stocks, the yields and properties of products are illustrated in Table 2. This table includes data for light and heavy flashed distillates and a heavy catalytically cracked gas oil. This last material is representative of either a catalytic recycle stock or one which could be fed to the second stage of a two-stage catalytic cracking unit. Data are given for operation at both 750 psig. and 1,500 psig.

Excellent sulfur removal is indicated at both pressure levels. Indicated polyaromatic reduction is greater at the higher than at the lower pressure, and as a result of the higher hydrogen consumptions at the higher pressure, nitrogen reduction is also more extensive.

A small yield of light hydrocarbon gas (butane and lighter) was measured in all experiments and the volume yield of total liquid product (gasoline plus gas oil) was, in all cases, over 100%. The small amount of gasoline formed during hydrogenation has been found to be an excellent catalytic reformer feed because of the high naphthene content.

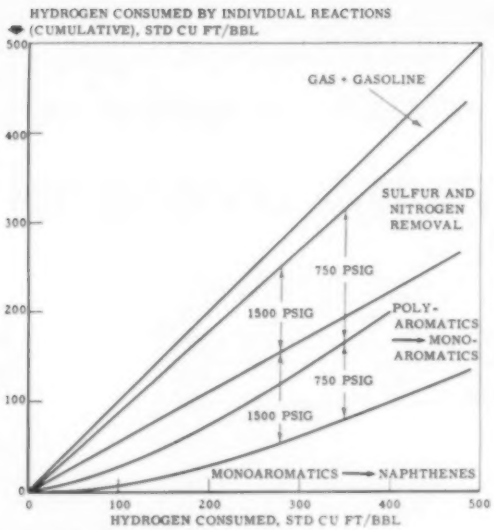
Cracking of Hydrogenated Stocks

The yields obtained from catalytic cracking of raw and hydrogenated

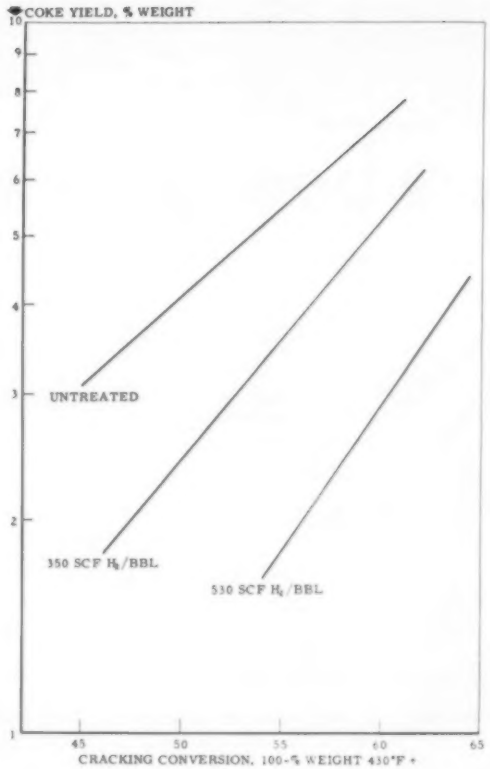
TABLE 1—HEAVY-METALS CONTENT OF HYDROGENATED FLASHED DISTILLATES

	West Texas flashed distillate			Kuwait flashed distillate		
	Concentration, p.p.m.			Concentration, p.p.m.		
	Untreated	210 std. cu. ft. of hydrogen per bbl.	Reduction (%)	Untreated	320 std. cu. ft. of hydrogen per bbl.	Reduction (%)
Iron	1.3	0.028	95+	0.91	0.084	90
Copper	0.013	0.0049	60	0.049	0.0088	80
Nickel	0.13	0.012	90	0.17	0.026	85
Chromium	0.0046	0.0028	50	0.014	0.0035	75
Vanadium	0.19	0.013	95	0.88	0.034	95
Sodium	0.26	0.015	95	0.86	0.46	45
Magnesium	0.029	0.0064	80	0.096	0.016	85
Calcium	0.055	0.012	70	....	....	..

*Hydrogasoline (C_5 to 450° F.) remained in catalytic cracking feed in the Kuwait and the cracked-gas-oil studies. Hydrogasoline was distilled out of catalytic cracking feed in the West Texas flashed-distillate studies.



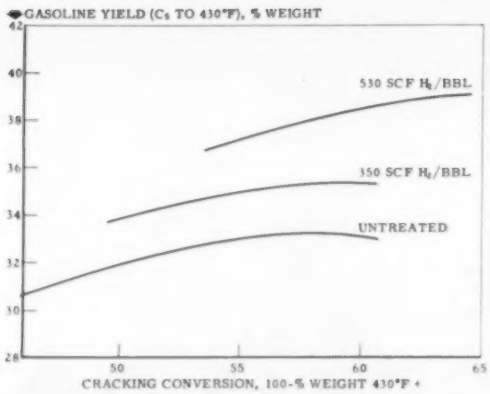
HYDROGENATION of West Texas flashed distillate. Hydrogen consumed by various reactions. Fig. 3.



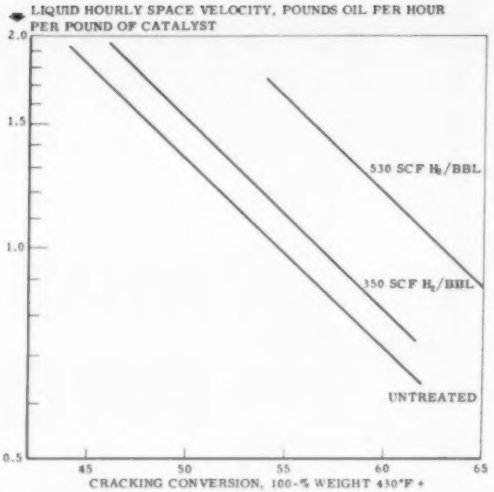
COKE YIELD from catalytic cracking of hydrogenated West Texas flashed distillate. Fig. 4.

TABLE 2—EXPERIMENTAL HYDROGENATION OF CATALYTIC CRACKING FEED STOCKS

	West Texas flashed distillate			Extra-heavy West Texas flashed distillate			Kuwait flashed distillate			Catalytically cracked heavy gas oil	
Pressure, psig.	.....	750	1,500	.....	750	1,500	.....	750	1,500	.....	750
Hydrogen consumed, std. cu. ft. per bbl.	None	350	530	None	240	570	None	375	455	None	500
Reduction, %:											
Sulfur	.....	93	97	.....	76	96	.....	85	89	.....	94
Nitrogen	.....	61	85	.....	24	82	.....	37	63	.....	29
Polyaromatics	.....	48	73	.....	23	69	.....	43	65	.....	34
Yields, % by wt. of hydrogenation feed:											
Hydrocarbon gas (butane and lighter)	.....	0.3	0.6	.....	0.5	0.7	.....	0.3	0.3	.....	0.2
Heterogas (hydrogen sulfide, ammonia, steam)	.....	1.7	1.8	.....	1.5	2.2	.....	2.6	2.7	.....	1.7
Gasoline (C_5 to 450° F.)	.....	2.9	4.0	.....	2.2	1.9	1.3	2.7	3.3	}	}
Gas oil	100.0	95.6	94.5	100.0	96.2	96.2	98.7	95.1	94.5	} 100.0	} 99.0
Yield of total liquid product (gasoline plus gas oil), vol. %	100.0	100.6	101.5	100.0	100.9	101.1	100.0	101.0	101.7	100.0	101.7
Properties of catalytic cracking feed*—											
Gravity, °API	25.5	28.4	29.9	22.1	25.7	26.5	23.4	28.4	29.5	21.5	25.7
Sulfur, % by weight	1.68	0.12	0.05	1.82	0.44	0.07	2.91	0.44	0.32	1.52	0.09
Nitrogen, % by weight	0.13	0.05	0.02	0.17	0.13	0.03	0.08	0.05	0.03	0.07	0.05
Monoaromatics, millimoles per 100 g.	67	81	78	57	73	78	63	91	97	39	70
Polyaromatics, millimoles per 100 g.	59	31	16	65	50	20	62	36	22	126	83
Mol. wt.	349	.....	.....	464	.....	.....	374	.....	.....	305	290
Catalytic cracking yield, % by weight of cracking feed—											
At constant conversion:											
Conversion (100 minus % by weight of 430+ °F. material)	56	56	56	60	60	60	55	55	55	50	50
Coke yield	5.8	3.9	2.0	6.8	5.0	2.2	5.6	3.7	2.5	12.6	7.1
Gasoline yield (C_5 to 430° F.)	33.1	35.2	37.5	37.8	39.0	41.7	32.6	35.7	37.1	23.1	28.1
At constant coke:											
Conversion (100 minus % by weight of 430+ °F. material)	49.5	56.3	63.4	53.0	60.0	69.0	49.7	56.2	60.0	42.5	56.5
Coke yield	4.0	4.0	4.0	5.0	5.0	5.0	4.0	4.0	4.0	10.0	10.0
Gasoline yield (C_5 to 430° F.)	31.8	35.2	39.0	35.6	39.0	43.1	31.8	36.0	38.3	21.0	29.3



GASOLINE YIELD from catalytic cracking of hydrogenated West Texas flashed distillate. Fig. 5.



SPACE VELOCITY required for catalytic cracking of hydrogenated West Texas flashed distillate. Fig. 6.

feeds are as shown in the lower part of Table 2 and illustrated in Figs. 4 and 5. At constant conversion, the yield of coke is decreased as much as 65% (basis coke) and the gasoline yield is improved as much as 20% (basis gasoline). Advantage of the lower coke can be taken, for example, by increasing conversion to obtain a constant coke yield; these data are shown in the lower part of the table.

For this operation, gasoline yield is improved as much as 40% (basis gasoline). Table 3 shows that the benefits of increased gasoline and decreased coke are complemented by a lower dry-gas yield (ethane and lighter) and an increase in the yield of propylene and butylenes.

A further advantage of hydrogenation is that it permits the use of higher space velocity. Fig. 6 indicates that with 530 std. cu. ft. of hydrogen per barrel in the flashed distillate, the space velocity in a laboratory fluidized fixed-bed catalytic cracking unit can be increased by approximately 80% relative to that required for the untreated feed.

All of the catalytic cracking data reported herein were obtained with the use of the same catalyst for both the untreated feed and the hydrogenated gas oils. The catalytic cracking yields do not, therefore, reflect the additional yield advantage which results when the hydrogenated gas oil is cracked over a catalyst having a lower contaminant-metal content than the catalyst used for the untreated feed. This additional yield advantage should be obtained in commercial operation because of the metals reduction obtained through hydrogenation.

TABLE 3—CATALYTIC CRACKING YIELDS FROM HYDROGENATED WEST TEXAS FLASHED DISTILLATE

Yields, % by wt. of catalytic cracking feed:	Untreated	350 std. cu. ft. of hydrogen per bbl.	530 std. cu. ft. of hydrogen per bbl.
Ethane and lighter	4.9	3.7	2.6
Propylene	4.1	4.5	4.6
Propane	1.7	1.2	1.0
Butylene	3.5	4.2	4.9
Butanes	2.3	2.8	2.9
Gasoline (C_5 to 430° F.)	33.0	35.0	37.2
Light gas oil (430° F. to 650° F.)	25.0	26.0	27.0
Heavy gas oil (650+ °F.)	20.0	19.0	18.0
Coke	5.5	3.6	1.8
Total	100.0	100.0	100.0

TABLE 4—PROPERTIES OF PRODUCTS FROM CATALYTIC CRACKING OF UNTREATED AND HYDROGENATED WEST TEXAS FLASHED DISTILLATE
(Constant conversion)

	Untreated feed*	Hydrogenated feed†
Gasoline (70° to 450° F.)—		
Research octane number (ASTM D 908):		
Without TEL addition	94.0	95.3
With addition of 3 ml. TEL per gal.	98.0	99.6
Motor octane number (ASTM D 357), without TEL addition	84.1	86.0
Sulfur, % by weight	0.18	0.01
Light gas oil (450° to 675° F.)—		
Gravity, °API	21.4	25.6
Sulfur, % by weight	1.5	0.12
Aniline point, °F.	104	117
Diesel index	22	30
Color, ASTM:		
Without aging	1½	1¼
After aging at 212° F.:		
For 24 hours	3¼	1¾
For 48 hours	3¾	2¼
Heavy gas oil (675+ °F.)—		
Gravity, °API	15.1	22.2
Sulfur, % by weight	1.4	0.34
Nitrogen, % by weight	0.08	0.03
Viscosity (Saybolt Universal) at 210° F., seconds	40	38

*Contains 0.6% of naphtha which may lower octane numbers of catalytic gasoline by approximately 0.3 unit. Hydrogenated feed contains no naphtha. †460 std. cu. ft. of hydrogen per barrel.

Product quality . . . In addition to the yield advantages, the quality of the gasoline and gas oil from a hydrogenated feed stock is superior to that from an untreated feed. This is illustrated in Table 4. Catalytic gasoline from the hydrogenated feed tests higher in octane number, both motor and research, and lower in sulfur content. For the light gas oil, sulfur is decreased appreciably, diesel index is higher, and color stability is improved.

These advantages make possible both a better furnace oil and a better diesel fuel from a hydrotreated feed

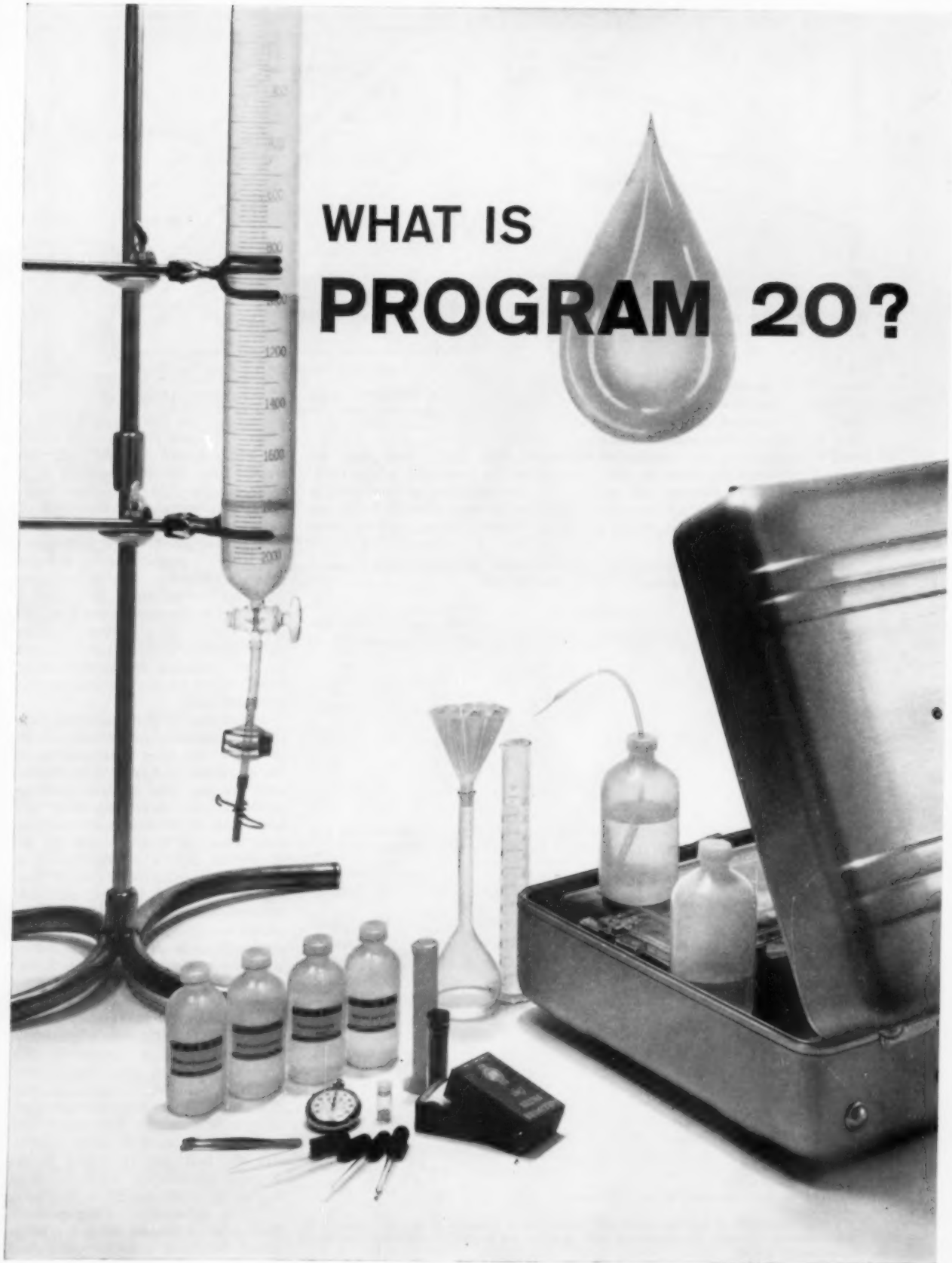

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TABLE 5—PERFORMANCE OF COMMERCIAL CATALYTIC CRACKING FEED-HYDROGENATION UNIT

Hydrogenation—	Feed	Stripper liquid tops	Stripper bottoms
Yield, vol. %	100	0.7	99.9
Gravity, °API	23.2	45.4	27.3
Sulfur, % by weight	2.78	0.38	0.58
Conradson carbon, % by weight	0.45	.....	0.16
Monoaromatics, millimoles per 100 g.	62	.....	91
Polyaromatics, millimoles per 100 g.	62	.....	36
Nitrogen (basic), p.p.m.	470	.....	360
Color, NPA	7	.....	3
Research octane number (ASTM D 908):			
Without TEL addition	.....	47.3	.....
With addition of 3 ml. TEL per gal.	.....	69.1	.....
ASTM distillation, °F.:			
Initial boiling point	582	120	460
50% point	680	426	680
Catalytic cracking—			
Conversion (100 minus % by weight of 450+ °F. material)	57.7	.....	58.4
Yields, % by weight of catalytic cracking feed:			
Gasoline (C_5 to 450° F.)	35.1	.....	37.6
Coke	6.1	.....	4.4
Ethane and lighter	3.8	.....	3.0

to catalytic cracking. The increase in gravity and decrease in sulfur, nitrogen, and viscosity of the heavy gas oil indicate an improved thermal cracking feed.

Commercial Operation

A commercial unit for hydrogenation of catalytic cracking feed stock has been operated by Shell Oil Co. of Canada, Ltd., for approximately 1½ years. Typical performance data, obtained while processing Kuwait flashed distillate, are shown in Table 5.

Although operations are adjusted to give a mild treatment, a substantial improvement in the quality of catalytic cracking feed is indicated by the four-unit increase in API gravity, 80% reduction in sulfur, and 65% reduction in Conradson carbon. The 42% reduction in polyaromatics shows up as an equivalent increase in monoaromatics content.

An improvement in color and a 25% reduction in basic nitrogen content are also indicated.

The hydrogenated Kuwait flashed distillate usually is catalytically cracked in admixture with untreated feeds from other crude-oil sources. A series of tests has, however, revealed the yield changes which would result if the Kuwait stocks were cracked alone. Comparative cracking yields are shown at the bottom of Table 5.

The increase in gasoline yield resulting from hydrogenation is approximately 7% (basis gasoline), while the decrease in the combined yield of coke and ethane and lighter is approximately 25% (basis coke plus ethane and lighter). Alternately, the improved feed quality, indicated in Table 5, can be exploited in a catalytic cracking unit which is limited only by coke-burning capacity by either of the following: (1) increasing conversion approximately 10% (basis feed) at constant feed rate, or (2) increasing feed rate approximately 35% at constant conversion.

Other benefits resulting from the feed hydrogenation are improved octane number of the catalytic gasoline and lower sulfur content of the gasoline, No. 2 fuel oil, and cutter stock. These results are in agreement with the laboratory data shown in Table 4.

Because other commercial cracking tests which have been reported herein for the untreated and the hydrogenated feeds were within a few days of each other, the heavy-metal-contaminants content of the cracking catalysts were indentical for the two tests. The cracking yields do not, therefore, reflect the additional advantage which would result if catalysts with equilibrium heavy-metals content were used in each test.

Although laboratory and plant data have indicated quite conclusively the detrimental effect of heavy metals on cracking catalysts, no comparable ill effect has been observed as the result of heavy-metals deposition on the hydrogenation catalyst. In theory, some of these deposited metals might be expected to behave like hydrogenation catalysts. In practice, no significant effect has been observed during 1½ years of commercial operation.

In this connection, it is interesting to note an approximation which relates the maximum metals deposition on hydrogenation catalyst as a function of operating conditions. If a catalyst removes 1 p.p.m. of heavy metals from an oil feed for 1 year, while operating at a liquid hourly space velocity of 1, the accumulation on the catalyst will approximate 1%.

Economics . . . The improvement of both catalytic cracking yield structure and product quality, which has been reported herein, can often make catalytic feed hydrogenation a profitable operation. Because hydrogenation relieves the cokeburning bottleneck which limits many existing catalytic cracking units, an added economic benefit can frequently result when feed hydrogenation is installed in an existing refinery.

This added benefit can be obtained by operating the existing catalytic cracking unit either at higher conversion levels or at higher feed rates. When feed hydrogenation is provided as part of a new refinery, the corresponding added benfit is obtained largely through the reduced capital cost of the coke-burning equipment required for the catalytic cracking unit.

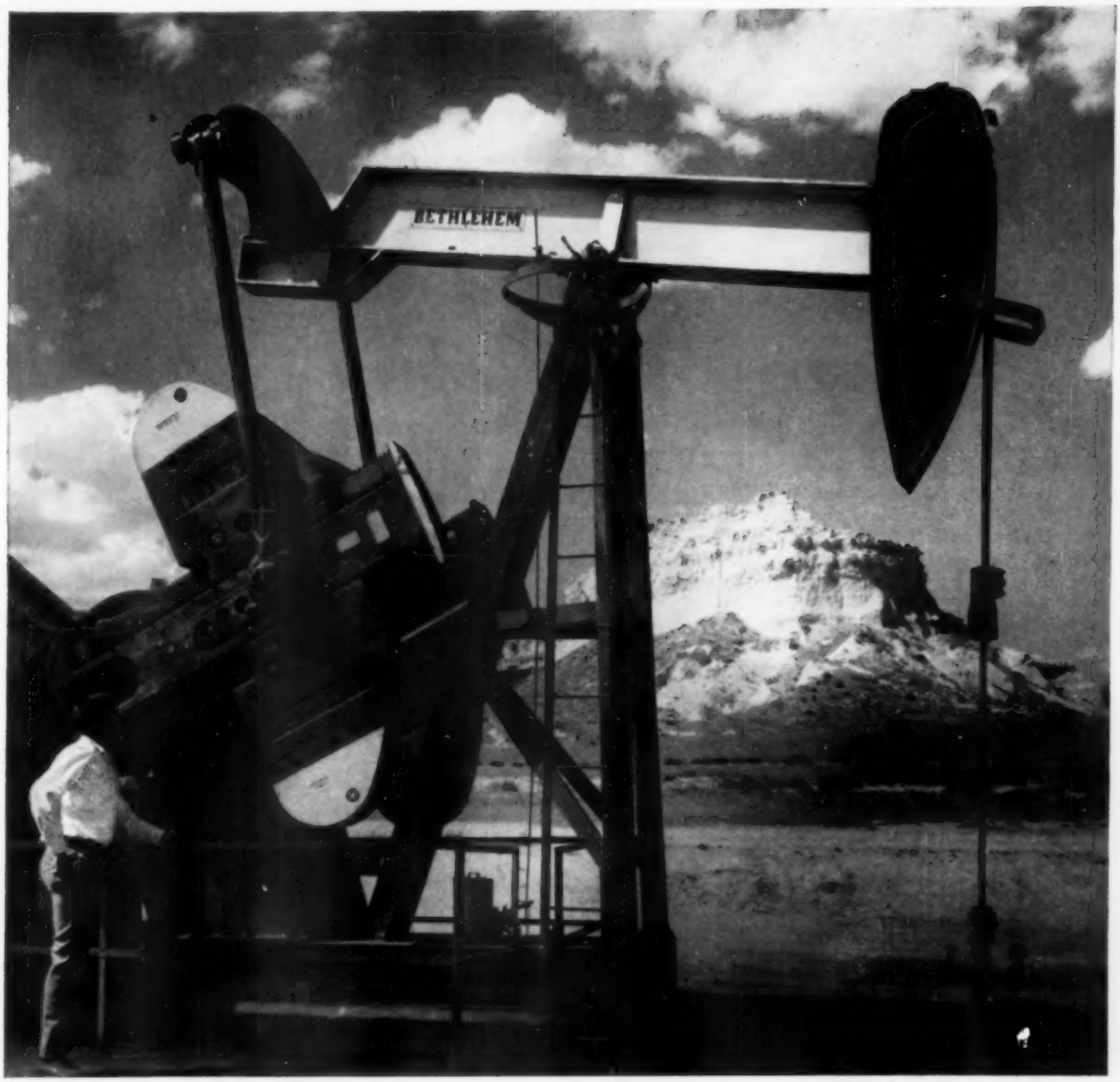
Straightrun feeds . . . Introduction of a new high-sulfur crude oil into a refinery may, at times, create a need for new desulfurization facilities for one or more of the catalytically cracked products. In this situation, the desired sulfur reduction may be obtained either by desulfurizing the products or by hydrogenating the feed to the catalytic cracking unit.

The economics in this case depend, in part, on the size of the required feed-hydrogenation unit relative to the size of the product hydrodesulfurizer replaced. In some applications studied, the capital and operating costs of the feed-hydrogenation unit are only slightly greater than the comparable costs for the product treated. In this situation, the economics for catalytic cracking feed hydrogenation are quite favorable.

Second-stage cracking feeds . . . Economic studies have shown that two-stage catalytic cracking is often more profitable than single-stage. The first commercial unit employing this new technique was installed by Shell at its new refinery at Anacortes, Wash.[14]

Other economic studies have shown that hydrogenation of the cracked gas-oil feed to the second stage of catalytic cracking may be more profitable than hydrogenation of the straight-run feed to the first stage. This normally occurs when the desulfurization credits, which have been described herein, are not obtainable.

Other factors also contribute to the favorable economics for hydrogenation of a heavy catalytically cracked gas-oil feed to the second stage of two-stage catalytic cracking. First, experimental data indicate that the extent of improvement in catalytic cracking yields is related to the total



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quantity of polyaromatics hydrogenated.

Second, catalytically cracked gas oils contain high concentrations of polyaromatics and, therefore, the potential improvement is great. Third, theoretical considerations and experimental data show that catalytically cracked gas oils are more easily hydrogenated than are straight-run stocks.

Therefore, a big improvement can be made in quality while employing mild hydrogenation conditions. Inasmuch as use of mild hydrogenation conditions leads to low capital and low operating costs, favorable economics are obtained.

The economics for hydrogenating . . . Heavy catalytically cracked gas-oil feed to the second stage have been evaluated for new refinery construction. The evaluation was made by calculating the capital and operating costs for two hypothetical refineries with the use of an electronic-data-processing digital-computer program. Both refineries employed:

1. Crude-oil distillation.
2. Flash cracking.[13]
3. Two-stage catalytic cracking.[11]
4. Catalytic reforming.
5. Catalytic polymerization of both propylene and butylene.
6. Hydrodesulfurization[15] of No. 2 fuel oil.

One refinery employed hydrogenation of the feed to the second stage of catalytic cracking; the second did not. Crude-oil input to the two refineries was adjusted to give an equal total production of both gasoline and No. 2 fuel oil. Results of this study indicated that the added capital cost of the refinery employing catalytic cracking feed hydrogenation was returned in less than 2 years.

In a supplementary calculation, the value of the products from the second stage of catalytic cracking was estimated by the use of Gulf Coast cargo low prices. This calculation indicated that the products from the hydrogenated feed were valued at approximately 50 cents per barrel of feed more than the products from the untreated feed. This differential remained approximately constant for all conversion levels studied (45 to 60%).

Costs

Capital and operating costs of hydrogenating catalytic cracking feed will vary with the capacity, operating pressure, required space velocity, and construction standards. The required pressure and space velocity will, in turn, vary with the properties of the feed.

In general, however, capital costs are in the range of $100 to $200 per daily barrel of capacity; the direct operating cost, which includes utilities, labor, maintenance, and catalyst, is normally less than 10 cents per barrel of feed.

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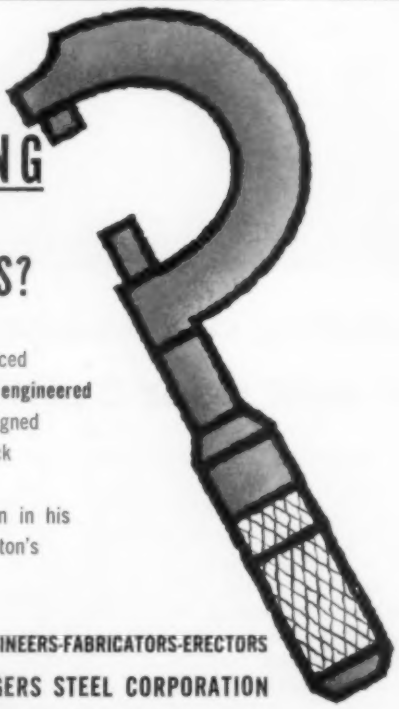

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Feed preparation

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Reduce gradually production of No. 6 fuel oil—maintain relatively high gasoline yield by combining deep feed preparation, such as flash cracking, with two-stage cat cracking. This process makes maximum use of a cat cracking process in its most efficient manner.

BY W. V. MEDLIN, J. C. ORNEA, AND A. J. JOHNSON
Shell Development Co.

THE TREND in catalytic - cracking feed preparation is to produce larger quantities of suitable distillates.

Vacuum flashing to high distillate yields, limited by metallic - contaminants carryover, is attractive. Other feed-preparation processes effectively reduce the metallic-contaminants content of the distillate feed. A simple combination of viscosity breaking and vacuum flashing of long residue is termed "flash cracking." Another feed-preparation step is solvent deasphalting of vacuum-flasher pitch and fluid coking.

Solvent deasphalting produces distillates giving low coke makes in catalytic cracking; flash cracking is best from the standpoint of metals rejection. Flash cracking is somewhat more flexible and adaptable to changing market conditions because it can produce either No. 6 fuel oil or a small yield of unblended solid pitch.

The best pattern for future refinery construction combines feed preparation for maximum yield and two-stage catalytic cracking.

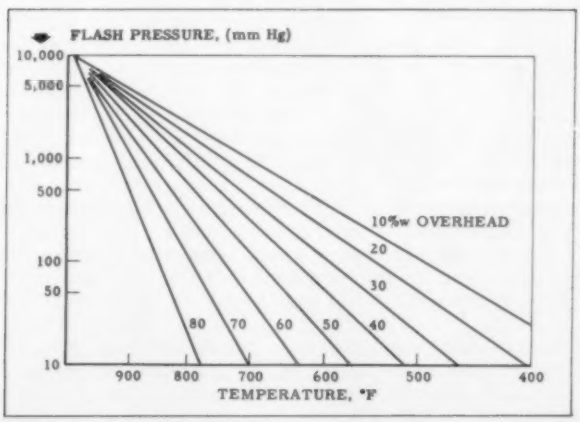
Paper presented at API Division of Refining annual meeting, Los Angeles, May 12-15, 1958, under the original title, "Catalytic-Cracking Feed Preparation."

Vacuum flashing . . . Vacuum flashing is the process widely used by Shell Development Co. and by many other refiners to prepare catalytic cracking feed stock. A straightrun residue, coming hot from the crude-oil distillation unit, is further heated in a furnace, where some of it is vaporized under vacuum.

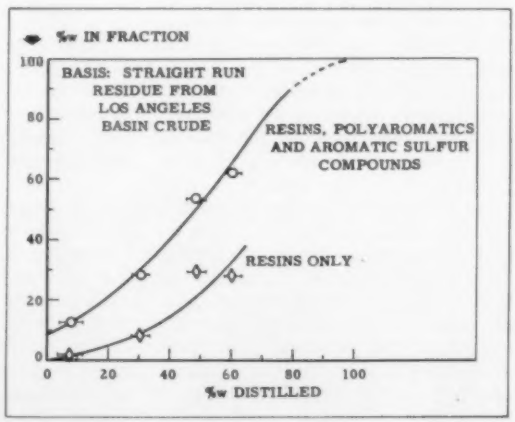
A phase-separation vessel follows, consisting of a cyclone separator topped with a disengaging section for removal of entrained pitch. Condensation of overhead is generally carried out in two steps at two temperature levels for purposes of heat economy.

A major portion of the equipment is concerned with phase separation because of the importance of obtaining a clean overhead product. Although a well-designed cyclone is highly efficient for this purpose, the use of a rectifying section is also desirable, both because some small drops are entrained from the cyclone and because of the somewhat improved fractionation which is obtained.

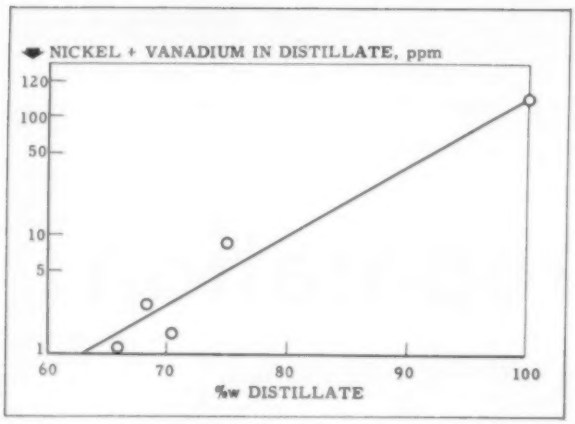
In vacuum flashing, the maximum temperature generally in use is 800°



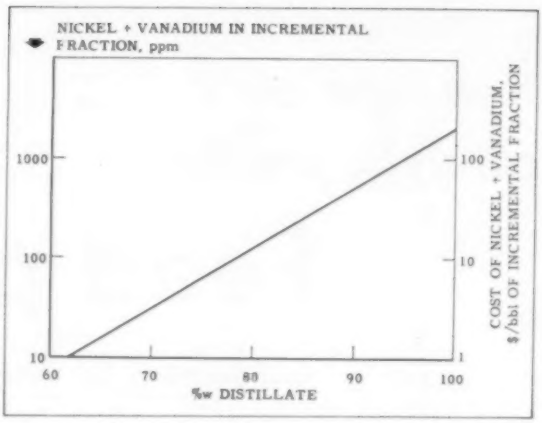
FLASH VAPORIZATION of Los Angeles Basin straightrun gasoline. Fig. 1.



COMPOSITION of straightrun fractions. Fig. 2.



METALS in vacuum flasher distillate from Los Angeles Basin straightrun residue. Fig. 3.



METALS in incremental fractions from vacuum flashing Los Angeles Basin straightrun residue. Fig. 4.

F. This temperature is limited by the tendency of the feed stock to crack, thus forming gas and making more difficult the achievement of the necessary vacuum. In most designs, the minimum absolute pressure at the point of inlet is on the order of 100 mm. of mercury. Lower pressures are used in some instances, but considerably increased plant size and cost ensue as this pressure is reduced.

The yield of overhead product from vacuum flashing depends, of course, upon the pressure and temperature employed at the effective flash point measured at the cyclone inlet. Fig. 1 is an illustration of the effect of flash pressure and temperature upon the yield in a single flash separation.

It is seen that at the maximum temperature of 800° F. the amount flashed increases from 50 to 80% as the pressure is reduced from 600 to 25 mm. Thus the performance of the vacuum flasher depends greatly upon the pressure for which it is designed.

Lower pressures . . . One obvious way of increasing the proportion of crude oil charged to catalytic cracking is to build vacuum flashers of lower pressure, or to build secondary high-vacuum flashers operating upon regular vacuum-flasher pitch. In the case of Los Angeles Basin crude oil, the effect of doing this is illustrated in Table 1.

As the vacuum-flasher pressure is reduced, the percentage of crude oil being charged to catalytic cracking rises, and pitch yield is correspondingly reduced. Using single-stage once-through catalytic cracking upon the vacuum-flashed material, the most noteworthy change in yield structure shown is a substantial reduction in No. 6 fuel oil and a corresponding increase in yield of lighter distillate and gasoline.

TABLE 1—EFFECT OF DEPTH OF FEED PREPARATION ON REFINERY YIELDS

Amounts in Per Cent by Volume of Los Angeles Basin Crude Oil

	Vacuum flashing	
	Mild	Deep
Vacuum-flasher charge	53.0	53.0
Vacuum-flasher overhead	21.5	42.5
Thermal cracking charge:		
Flasher pitch	31.5	0
Heavy catalytically cracked gas oil	4.5	9.0
Platformer charge	16.7	16.7
Yields of principal products:		
10-lb. R.v.p. gasoline	44.7	45.3
No. 2 fuel oil	11.3	14.5
No. 6 fuel oil	36.5	28.1
ASTM octane number (D-908, research method), with 3 ml. TEL	96.4	97.6

The decrease in the ratio of residual fuel oil to gasoline is 24% with a corresponding increase in No. 2 fuel oil, and this is accomplished in the present example with a crude oil which by nature produces a relatively high yield of this residual material.

Catalytic Cracking of Residues

Because of the apparent advantages in charging very deeply flashed material to catalytic cracking units, a question may be raised as to whether feed preparation could be abolished and the entire long residue catalytically cracked. Such an operation is indeed carried out in some instances, notably in the Houdresid process employed by Sun Oil Co. in a moving-bed unit at Sarnia, Ont.,[1] and in a fluid unit by Frontier Refining Co. at Cheyenne, Wyo.[2]

We believe, however, that with most feed stocks and in most refineries such an operation, although technically feasible, might not be economically desirable. This would be especially true of Los Angeles Basin residue. An illustration of the type of problem which would be encountered is given in Fig. 2, where analytical data are presented for fractions distilled under vacuum from straightrun residue derived from the atmospheric-pressure distillation of Los Angeles Basin crude oil.

From catalytic cracking experiments on purified fractions, it has been previously learned that resins, polyaromatic, and aromatic sulfur compounds are especially severe coke formers in catalytic cracking, and that resins in particular tend to crack almost completely to coke. The curves in Fig. 2 indicate that the sum of resins, polyaromatic, and aromatic sulfur compounds rises rapidly with per cent distilled, reaching 80% at 70% overhead.

At the same overhead yield, resins alone account for more than 40% of these compounds. The implication from these data would be that extremely high coke yields would be obtained from the marginal overhead material as the latter approached 100%. In view of the high cost of burning carbon from catalyst, it seems obvious that the last 10 or 20% of Los Angeles Basin straightrun residue should not be catalytically cracked.

An even more serious argument for feed preparation, however, lies in the tendency of metals to concentrate in the heaviest residual fractions. Fig. 3 illustrates this tendency. Here the total amounts to nickel plus vanadium in overhead products are plotted for vacuum flashing as a function of per cent by weight of overhead distillate, and a very strong increase with per cent flashed may be noted. Metallic contamination of cracking catalyst has been shown to affect catalyst activity and product distribution, particularly in increased coke yields.

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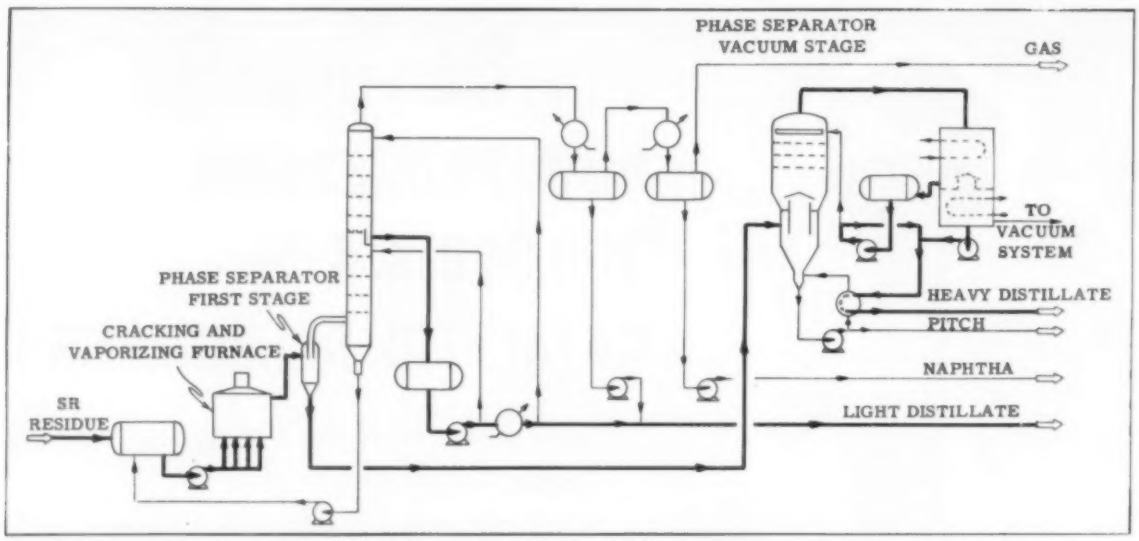


SCHEMATIC flow sheet of a flash cracking unit as designed by Shell Development Co. Fig. 5.

The economic effect of metals in the feed to a catalytic cracking unit is not known with certainty and varies depending upon plant operating conditions, the metals concentration in the feed, catalyst activity, and other factors. In our attempts to determine a figure for the cost of metals, it has turned out that this cost probably lies in the range $200 to $1,000 per pound of nickel plus vanadium charged to the unit with the feed.

Taking as correct the arbitrary figure of $300 per pound, Fig. 4 indicates that at the 80% overhead level the metals concentration in the incremental feed is such that it costs approximately $12 per barrel to charge it to the unit. Even at 62% overhead, this cost may be as much as $1 per barrel. And even if we accept these figures as order-of-magnitude calculations only, it is quite evident that a severe limitation exists as to the amount of feed stock that can economically be taken overhead in a flashing operation.

No other feed-preparation process can be used at high yields, either, unless it is much more effective than vacuum flashing in removing the bulk of the metal contaminants.

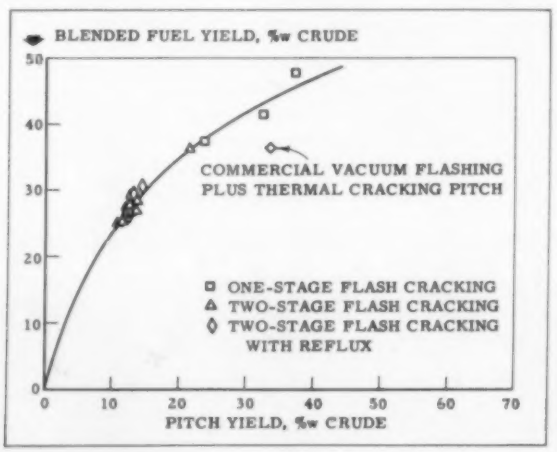
Deep Feed Preparation

One simple feed-preparation process extensively studied by Shell Development Co. is the combination of viscosity breaking and vacuum flashing of long residue, termed by Shell "flash cracking." Fig. 5 is a schematic flow sheet of a flash cracking unit as designed by Shell Development Co.

Straightrun residue is charged to a furnace having a contact time of only a few seconds and a transfer temperature of approximately 925° F. This material enters a small cyclone separator at a pressure of approximately 30 psig. The vapor from the cyclone separator enters a column where partial condensation takes place and some knockback is created to reduce entrainment. Overhead condensation equipment is similar to that used in the vacuum flasher.

Liquid from the cyclone is vacuum-flashed without reheating in a phase-separation vessel, at a pressure which may be as low as 20 mm. of mercury. Because of the high temperature of the first-stage flash, an extremely short holding time for the liquid in the cyclone is necessary and thus a rapidly acting liquid-level control valve is provided between the two flashing stages.

Knockback material for deentrainment in both flash stages is returned to the feed, and a recycle is introduced which may amount to 10 to 20% of the fresh feed. This recycle is effective in reducing metals contamination.



BLENDED FUEL-OIL YIELD from flash cracking Los Angeles Basin straightrun residue. Fig. 6.

Low pitch yield . . . Under these conditions, the yield of pitch from the flash cracking unit may be as little as 10% of the Los Angeles Basin crude oil. It is partially cracked, but can be mixed with aromatic cutter stock to produce a fuel meeting the viscosity specifications for No. 6 fuel oil.

When cooled, it solidifies into a hard, brittle tar having a softening point between 250° and 300° F. The substance resembles coke and may be handled in a similar fashion; for example, it is easily ground and can be utilized as furnace fuel with proper handling equipment. Thus the flash cracking process may be said to have the flexibility to permit operation to

either blended fuel for sale or an underboiler coke-like material, as desired.

The yield of blended fuel as a function of pitch yield is illustrated in Fig. 6, together with a point representing a normal refinery operation with vacuum flashing followed by thermal cracking of flasher pitch. It is seen that for the same yield of pitch in the feed-preparation unit, the flash cracking unit makes more No. 6 fuel oil. At lower pitch yields, the production of No. 6 fuel oil is reduced below the present level.

Thus flash cracking has the effect of reducing refinery yield of No. 6 fuel oil without the necessity for further thermal cracking of flasher pitch.

Alternative process . . . An alternative deep feed-preparation process is solvent extraction of vacuum-flasher pitch. This process has been advocated primarily by the M. W. Kellogg Co. and is called "solvent decarbonizing."[3] It is similar to the propane deasphalting of lubricating oils, the chief difference being that it utilizes a relatively low solvent-oil ratio and, in some cases, a mixture of propane and butane as solvent.

Pitch from a vacuum flasher is prediluted with solvent and charged to a contact tower where a countercurrent flow of the remainder of the solvent is introduced. With careful attention paid to both the temperature of extraction and the temperature profile, separation is achieved between the overhead extract and the asphaltic raffinate, both of which are heated for removal of solvent by flashing. Successive flashing stages are provided.

This process has been applied commercially at several locations. The cost, including that of the preceding vacuum flasher, has been found to be somewhat higher than that of the flash cracking unit, and the yield of overhead product is approximately the same. The selectivity of the solvent is such that the quality of the overhead deasphalted oil is somewhat better for the same yield and metal separation is improved—both as compared to vacuum flashing.

Coking is applicable . . . A third alternative approach to deep feed preparation is coking. The technique of delayed coking was in use for many years before catalytic cracking was known, and has been used to some extent since that time as a feed-preparation process, notably by General Petroleum Corp. of California.[4] This process utilizes a cracking furnace followed by a large vessel where flash separation and soaking take place.

TABLE 2—YIELDS FROM FEED-PREPARATION PROCESSES

Feed: Straightrun Residue from Los Angeles Basin Crude Oil.

Process— Yield, % by wt. of crude oil:	1 Conventional vacuum flashing	2 Deep vacuum flashing	3 Col. 1 plus solvent deasphalting	4 Flash cracking	5 Col. 1 plus delayed coking	6 Col. 1 plus fluid coking
C_2	....	....	....	0.3	2.2	2.0
C_3	....	....	....	0.2	0.9	0.8
C_4	....	....	....	0.2	0.9	0.5
Naphtha	....	....	....	2.9	6.1	4.2
Distillate	22.6	44.6	43.5	40.2	36.6	43.8
Pitch	35.0	13.0	14.1	13.8	....	....
Coke	....	....	....	....	10.9	6.3
Total	57.6	57.6	57.6	57.6	57.6	57.6

The liquid remaining in the vessel reacts to coke; usually several vessels are used in alternative filling and cleanout periods. Low pressures are desirable to obtain vaporization with minimum cracking, and thus maximum yields of distillates of good quality result. In spite of this, rather substantial amounts of low-quality gasoline are obtained, and distillates are degraded to some extent as catalytic cracking feed stocks.

Fluid coking, as introduced by Esso Standard Oil Co., overcomes this disadvantage rather well. This process has been extensively described.[5]

Feed stock, consisting of flasher pitch, is dispersed in a bed of finely divided fluidized coke maintained at a sufficiently high temperature to cause rapid reaction and vaporization. The time of reaction is shorter and the pressure is lower than in delayed coking; as a result, higher distillate yields of better quality and lower coke and gasoline yields are obtained.

Furthermore, heavier feed stocks may be charged, so that the capacity of the relatively expensive coking facilities need not be so great. Coke is circulated between the reactor and a coke burner, where heat is provided for the process. In the condensation and fractionation equipment a knockback is used to introduce a recycle; this feature aids in reducing entrainment of heavy ends and coke and results in improved metals separation.

Fluid-bed coking is a successful operation, and plants are in operation at several locations. The two largest have capacities of 42,000 bbl. per day and are operated by Tidewater Oil Co. at Avon, Calif., and in the new refinery at Delaware City, Del.[6]

The various feed-preparation processes which have been described herein include most of the basic types of operations known to the petroleum industry: distillation, mild thermal cracking, solvent extraction, and coking. All are used, and Table 2 compares their yields.

All the deep feed-preparation processes produce approximately the same quantity of catalytic cracking feed stock, with the principal exception of delayed coking which suffers in this respect because of its relatively high thermal severity.

Comparison of Processes

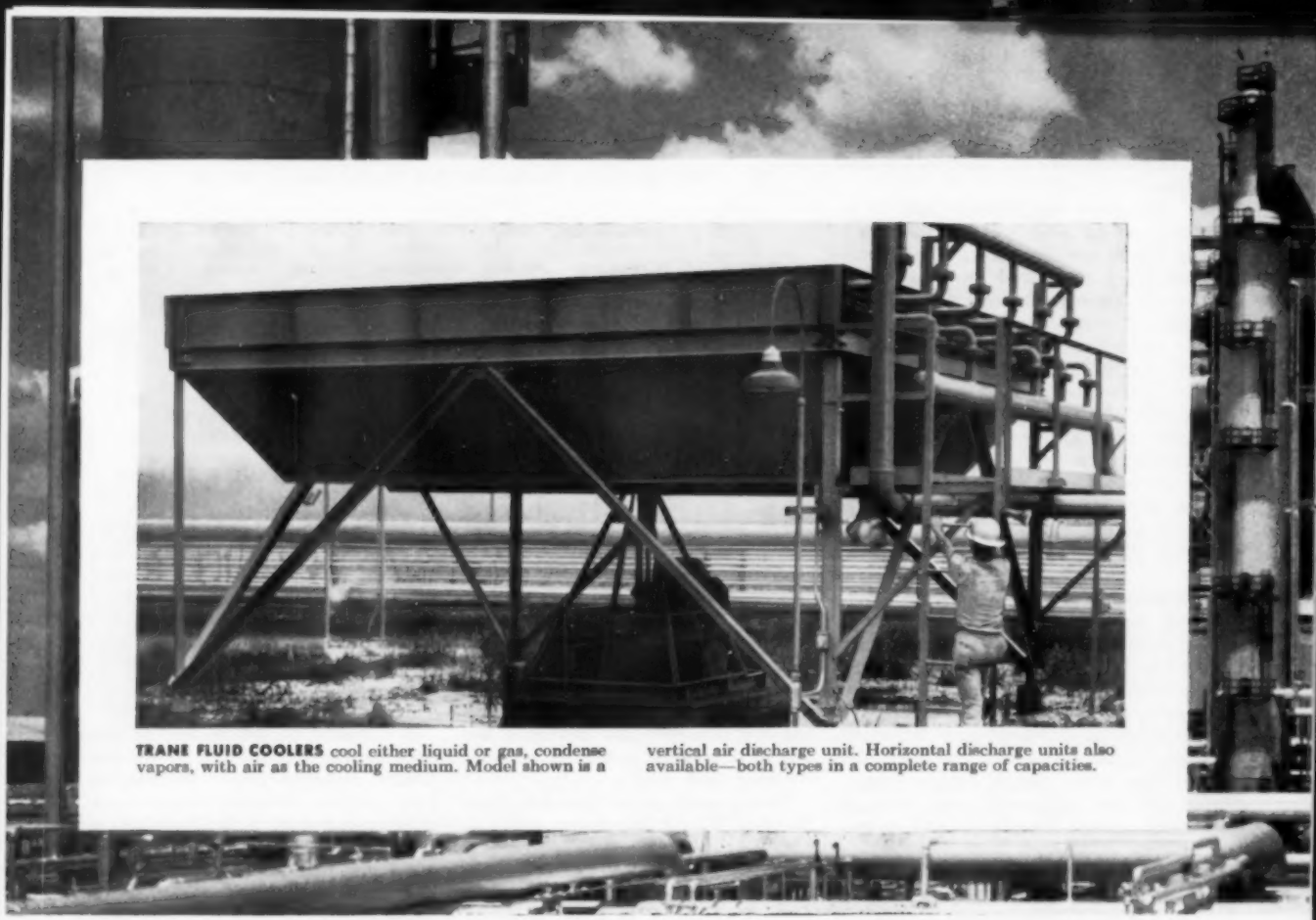
A measure of the quality of catalytic cracking feed stock is best expressed in terms of its tendency to form coke on cracking catalyst at a given conversion. Coke laydown in catalytic cracking is important economically because of the relatively high cost of regeneration facilities, and because most catalytic cracking units are limited in throughput by the coke-burning capacity available.

In Fig. 7 is shown the amount of coke produced in a laboratory fluid-bed catalytic cracking unit for three depths of feed preparation by vacuum flashing and, for comparison, by the alternative processes of deasphalting and flash cracking. An advantage is shown for deasphalting; at approximately the same overhead yield deasphalting appears to be somewhat better than vacuum flashing, and flash cracking somewhat worse.

These figures reflect the improved selectivity of the solvent extraction process and the relative degradation in the mild thermal cracking operation. The coking processes, although not shown, produce distillates with high coke yields relative to vacuum flashing, with delayed coking giving the poorer product.

Metals rejection . . . In metals rejection there is a somewhat different order of effectiveness. Fig. 8 illustrates the results of our analyses of overhead products for nickel and vanadium as functions of distillate product. The improvement for deasphalting over vacuum flashing is evident and reflects again the better selectivity in the extraction process.

Flash cracking, however, appears to be still better. Metal-containing com-



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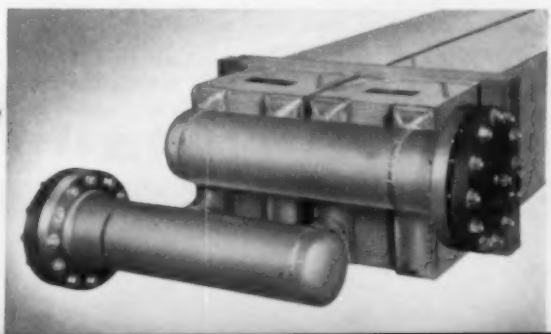
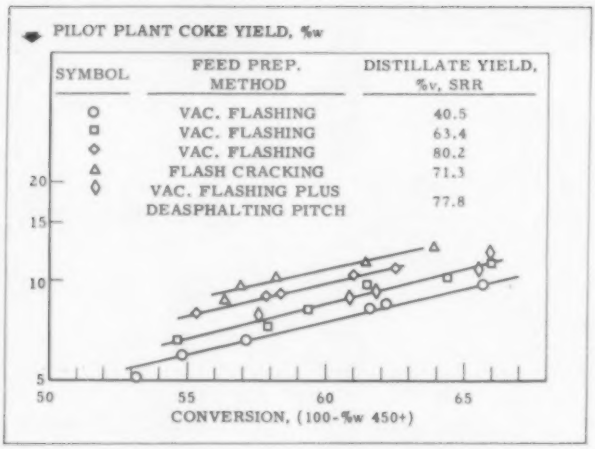
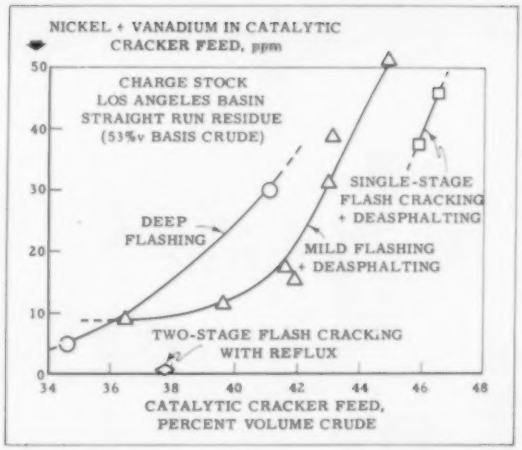




COKE YIELDS from cat cracking of Los Angeles Basin distillates, using different feed-preparation methods. Fig. 7.



CONTAMINANTS rejection by various feed-preparation techniques. Fig. 8.

pounds are preferentially decomposed in the mild cracking step; indeed, our observations have shown, in a number of instances, that the volatility of metallic compounds is greatly reduced with very mild thermal treatment. In our comparisons of processes, we have found that this advantage in metals rejection more or less offsets the disadvantage which has been described for the thermal degradation of the product, making the two processes relatively close together economically.

Two points are shown in Fig. 8 for a process in which deasphalting is substituted for the vacuum-flashing stage in a flash cracking operation. The improvement over mild flashing plus deasphalting is evident and again reflects the destruction of metallic compounds as a result of cracking.

Without a direct comparison at the same overhead yield, it is difficult to say if this combination is more effective than two-stage flash cracking, inasmuch as it does not involve the return of recycle which has been found effective in reducing metallic contaminants in the flash cracking process.

No comparative information is available on metals rejection in coking as compared to the processes displayed in Fig. 8. The rejection of metals would be expected to be at least as good as for flash cracking for the same overhead boiling range.

The economics of the various processes under discussion have been extensively studied by Shell Development Co. The principal conclusion is that the subject is very complex, with the result depending upon practically all aspects of refinery operation and product sales. We may cite the most obvious example: the problem of the disposal or sale of coke from a coking unit and the desirability of including coke as a regular refinery product.

Our conclusions from a number of economic studies are approximately as follows:

- For clean crude oils containing little pitch, such as Louisiana crude oils, deep vacuum flashing has been found to be adequate, and more severe devices are probably not justified.
- Coking is somewhat more expensive than the alternatives discussed; its profitability depends greatly upon the future outlook for the residual-fuel market. Although residual fuel just now is selling at too high a price to make coking attractive, the long-term trend which has been discussed may ultimately operate in favor of fluid coking for deep feed preparation.
- As between flash cracking and vacuum flashing-deasphalting, we have made careful comparisons for West Texas and Alberta crude oils and have concluded that economically they represent a tossup. Capital costs slightly favor flash cracking, and there is a considerable saving in direct operating costs as well. These are offset, to some extent, by the obvious advantage that deasphalting has of producing a superior catalytic cracking feed stock and no thermally cracked products.
- California crude oils appear to favor flash cracking because of the much better rejection of contaminating metals which it achieves.

Flexibility of operation is an intangible point to be taken into consideration in comparisons of this sort. It is our belief that flash cracking is perhaps the most flexible on two principal counts. First, it can accept considerable variation in crude-oil properties, particularly with respect to a material which may make considerably more pitch than that for which it was designed. Second, it can be used to produce either No. 6 fuel oil or a relatively small yield of unblended coke-like material; thus it is easily adaptable to changing market conditions.

Most of these data have pertained to Los Angeles Basin crude oil. This has been done because we of Shell Development Co. have been most concerned about California as the place

TABLE 3—COMPARISON OF FEED-PREPARATION AND CATALYTIC CRACKING PROCESSES FOR WEST TEXAS FEED

Feed-preparation process:	Vacuum flashing			Flash cracking	
Catalytic cracking process:	Single-stage	Single-stage	Two-stage	Single-stage	Two-stage
Feed to catalytic cracking, basis SRR, vol. %	66.0	66.0	66.0	86.7	86.7
Conversion basis of cracking feed (100 minus per cent by weight of 450+ F. material)	52.2	65.3	67.5	61.8	67.4
Recycle ratio*	1.8	2.2	1.8	2.0	2.0
Yields, basis SRR, per cent by volume:†					
Coke†	2.6	4.8	3.3	4.7	4.8
C_5 to 450+ F. gasoline	27.3	32.1	33.0	42.2	42.7
C_3=	2.7	2.9	5.1	3.8	6.1
C_4=	3.5	3.0	6.5	4.1	7.9
Polymer gasoline from olefins	4.5	4.3	8.5	5.8	10.3
Total gasoline	31.8	36.4	41.5	48.0	53.0

*Volumetric recycle ratio defined as total feed to all stages divided by fresh feed to first stage. †Coke yield only is in per cent by weight.

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where the greatest danger of overproduction of residual fuel oil exists.

It has been our observation that most of the conclusions and trends which have applied to Los Angeles Basin crude oil apply also, in some measure, to other crude oils and particularly to those of West Texas, where much of our additional experience is centered.

Catalytic cracking is less effective in raising gasoline yield and reducing No. 6 fuel oil in the case of California crude oil than with Texas and Mid-Continent stocks. In the latter cases, catalytic cracking tends to increase yields of intermediate distillates more than that of gasoline. The principal effect of deep feed preparation of all stocks appears also to result in increased distillate yields.

A desirable solution to this tendency toward unbalance would be to raise catalytic cracking conversion beyond the level of 50 to 55% which is generally used. This conversion is ordinarily limited by the cost of coke burning, and in some instances recycle has been introduced as a means of raising conversion within the limitations.

We have found, however, that two-stage catalytic cracking is a much more potent tool for raising conversion economically; thus the combination of this plus deep feed preparation is especially desirable.

"The economics of the various processes under discussion have been extensively studied by Shell Development Co. The principal conclusion is that the subject is very complex, with the result depending upon practically all aspects of refinery operation and product sales."

Table 3 illustrates the advantage of the combination of deep feed preparation and two-stage catalytic cracking over vacuum flashing followed by single-stage cracking. When yields are expressed on the basis of West Texas straightrun residue, it is clear that considerably higher gasoline production is achieved by flash cracking followed by two-stage catalytic cracking.

At approximately the same coke make, two-stage catalytic cracking following deep feed preparation yields 10% more C_5 to 450° F. gasoline on the basis of straightrun residue. If the propylene and butylenes are polymerized, the advantage in gasoline yield is even greater.

Best patterns . . . This, then, appears to be the best pattern for future refinery construction: to reduce gradually production of No. 6 fuel oil and to maintain relatively high gasoline yield by combining deep feed preparation—such as flash cracking—with two-stage catalytic cracking. This combination makes maximum use of a catalytic cracking process operated in its most effective manner.

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Where gas production is tough

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THE MESAVERDE formation is the major gas-producing formation in the San Juan basin, with the producing depth ranging between 4,500 and 6,500 ft. The Pictured Cliffs sandstone formation is the secondary gas-producing zone, with a producing depth ranging from 1,800 to 3,500 ft. The sand sections in both producing horizons are fine-grained sand with the average grain size being 0.10 mm.[1]

Permeabilities range from 0.01 to 8 md., the average being 1 md. This fact requires that the majority of the wells drilled have to be stimulated before commercial production can be obtained.[2] The number of producing wells in the basin at the present time is 3,439. Of this figure, 1,416 are Mesaverde producers and 2,023 are Pictured Cliffs producers. An addition of 600 new wells is planned by operators in the basin during 1958.

The Mesaverde gas is gathered into a 500-psi. line. The individual well production varies from as low as 25 M.c.f. to as high as 4,700 M.c.f. per day, with the average daily production being 650 M.c.f. The Pictured Cliffs gas is gathered into a 250-psi. line and the individual well production varies from as low as 10 M.c.f. to as high as 8,000 M.c.f. per day, the per well average being 400 M.c.f. Net effective pay and permeability appear to be the main factors for volume production.

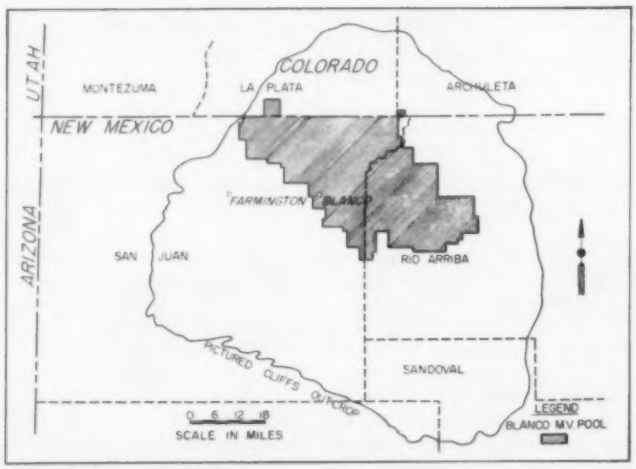
Production problems . . . Gas production is retarded by such factors as:

1. Liquid production, consisting of distillate, oil, and water. When the gas-to-liquid ratio reaches a certain point, the gas being produced is not capable of lifting all liquids coming into the well bore to the surface against existing line pressures. Eventually the well loads up with liquids. This restricts the flow of gas to the pipeline; and, in some cases, the liquids shut off production completely until the bottom-hole pressure builds up enough to lift the liquids to the surface.

The well remains on a productive status until enough liquids again accumulate in the well bore to restrict the production. The liquid production varies from 1 bbl. to as high as 125 bbl. per day. When the gas-liquid ratio is lower than 100,000 cu. ft. per bbl., then a well can be expected to give trouble insofar as loading up with liquids is concerned.

2. In localized areas, the Mesaverde production consists of crude oil with a high paraffin content. Accumulation of paraffin in the tubing restricts the gas flow; and in extreme cases, if not removed, will completely plug the tubing with paraffin deposits.

3. The early completion practices within the field were to drill to the top of the Mesaverde pay, set pipe, drill the pay zone with gas, and shoot the open hole with nitroglycerin. Tubing was set so that the perforations were opposite the lowest producing zone. As these wells were produced, the open hole in some cases would bridge between the upper and lower producing zones in the Mesaverde. This might even have happened during the initial potential test, which at that time required unrestricted flows to the atmosphere for as much as 6 hours.



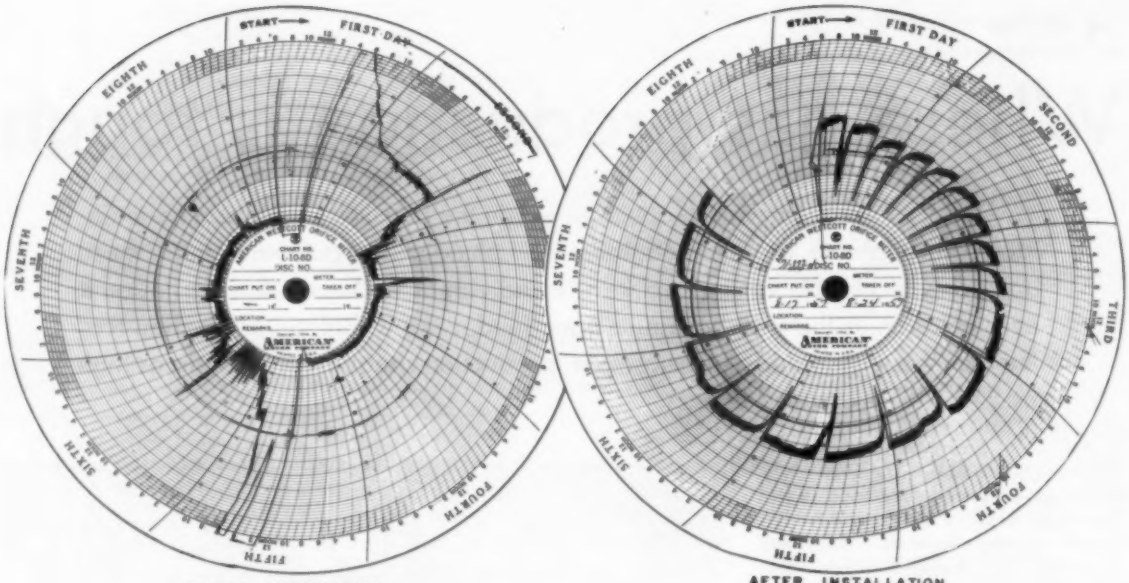
MANY OF THE GAS WELLS in the San Juan basin have production problems that prevent a steady output. Liquid accumulation in the well bore or paraffin deposits are the two main problems. Fig. 1.

BY A. J. DUDENHOEFFER
El Paso Natural Gas Co.

Use of Intermitters

The most common method of producing Pictured Cliffs wells is to complete the well with a 1¼-in. tubing string, commonly called a siphon or unloading string. Gas is produced to the sales line from the casing. Liquids

Paper presented at spring meeting, Southwestern District, API Division of Production, under the original title, Production Methods on Gas Wells in the San Juan Basin of New Mexico.



HERE WE SEE how the installation of an intermitter benefited this gas well. Production was upped 117% during the test period. Fig. 2.

that accumulate in the well bore are unloaded by use of a time-cycle controller operating a motor valve. As the motor valve is opened, the liquid accumulation is unloaded to the atmosphere. This is commonly referred to as purging the well. In each instance where liquids are unloaded to the air, gas used to bring this liquid to the surface is wasted. A portable test separator has been equipped so that gas liquid, and pressure data can be determined during the operation and purging of a well. Knowing these factors, the most suitable cycle that uses the least amount of gas to lift the water can be obtained.

Mesaverde completions . . . These wells are equipped with a 2-in. tubing string which is used as the producing string. The ability of the well to lift all liquids coming into the well bore with the gas as it moves to the surface depends upon velocity of the gas stream and the amount and type of liquids produced. As the velocity of the gas moving to the surface decreases, as a result of drawdown in the bottom-hole pressure, the pressure gradient in the tubing increases and reduces the gas flow.

So long as the formation is sufficiently competent, all that happens is:

1. The bottom-hole pressure is raised.
2. The production declines a little.
3. The pressure gradient in the tubing becomes steeper. This can progress to a point where the well will load up and die.

This condition will continue to exist until the bottom-hole pressure increases to a point which will unload liquids against existing line pressures. It may occur in a period of a few hours to several days. This condition can be alleviated before the well actually dies by opening the well to the atmosphere; then the enormous increase in velocity caused by pressure drop will literally purge the tubing string and reduce its pressure gradient. The economic optimum frequency of purging then becomes a compromise between the gas-production loss resulting from the liquid accumulation and the quantity of gas used to get rid of the liquids.

The water-lifting efficiency of the flowing gas in the tubing string is low, although the gas velocity at the surface is high. The flowing gas velocity at the bottom of the well, where velocity is most needed, is low because of the pressure gradient and friction loss in the tubing, so that the pressure drop at the bottom of the well bore is not nearly as high as at the surface. Therefore, a very large slippage loss is seen to exist.

Use of intermitters . . . This is not the case where liquid hydrocarbons are produced. Where liquids are salable hydrocarbons, they are collected in tanks on the location. When the purging frequency becomes stabilized, automatic time-cycle controllers or intermitters may be installed to perform purging operation. Typical orifice-meter charts showing production cycle before and after intermitter installation is shown in Fig. 2. Before intermitter was installed, during the first days of production, the well was purged manually for 15

TABLE 1—RESULTS OBTAINED BY INTERMITTERS—MESAVERDE WELLS

Well name—	Gas production, M.c.f.		
	Before	After	% increase
1-A Hughes	646	1,157	79.1
5 Hughes	239	259	8.4
8 Hughes	284	310	9.2
6 San Juan 28-7	83	107	28.9
10 San Juan 28-7	163	171	4.9
5 Stewart	90	196	117.0
7 San Juan 28-6	154	160	3.9
56 San Juan 28-6	976	1,084	11.0
5-A Day	439	510	16.2
5-A Hughes	532	594	11.7
3-A Roelofs	560	622	11.1
Average			27.4

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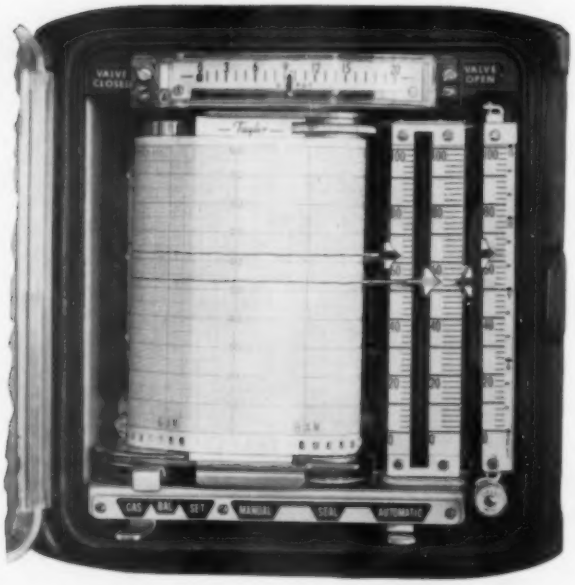

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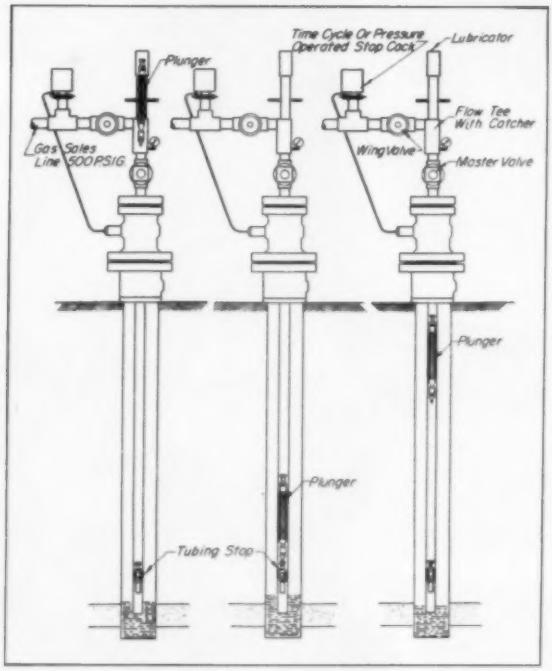
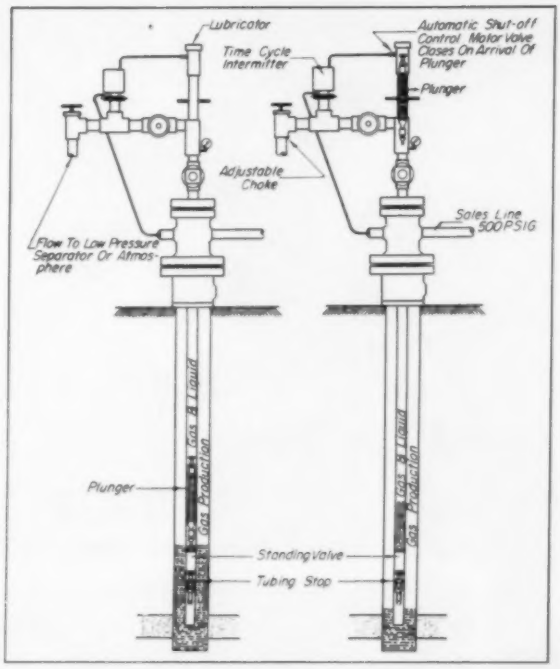
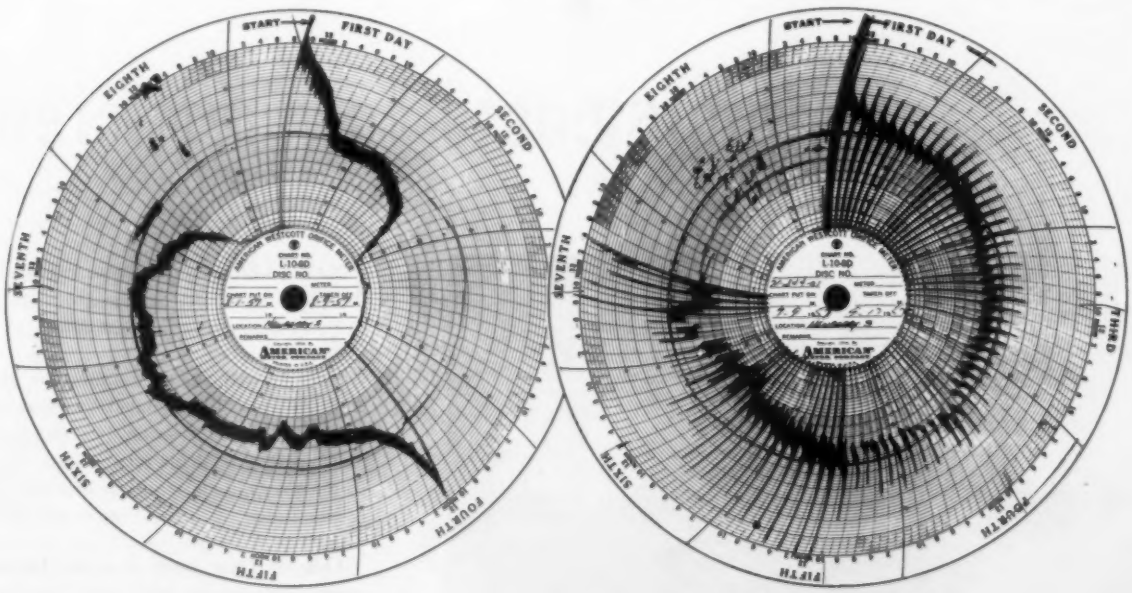


MOST DESIRABLE TYPE of plunger lift installation, in the opinion of the author. Trial-and-error tests determine the optimum cycle. Fig. 3.



ANOTHER TYPE of plunger-lift installation for wells that will not respond to the method outlined in Fig. 3. Notice that gas is produced through casing instead of tubing. Fig. 5.

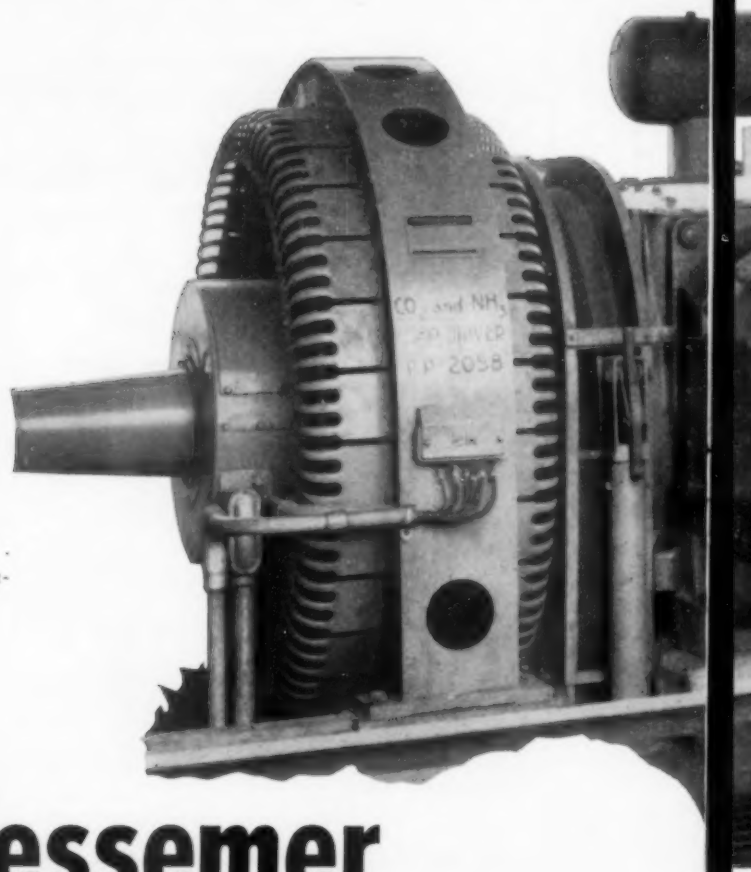
minutes. The well remained in good productive status until the third day when the gas production decreased as the result of liquid accumulation. This condition existed until the fifth day, when the well was again manually purged for 15 minutes. The production was again greatly restricted on the sixth day and remained so until this chart was changed. The average production for this period was 90 M.c.f. per day. An intermitter was installed and set to automatically purge the well for 15-minute intervals equally spaced four time per day. The purging cycle was cut to twice per day on the third day and the same results were obtained. The average production for this period was 196 M.c.f. per day, or an increase of 117%, with this method of oper-



BEFORE PLUNGER LIFT INSTALLATION

AFTER PLUNGER LIFT INSTALLATION

A PLUNGER-LIFT INSTALLATION on this well boosted production 24% from 629 M.c.f. per day to 780. Fig. 4.



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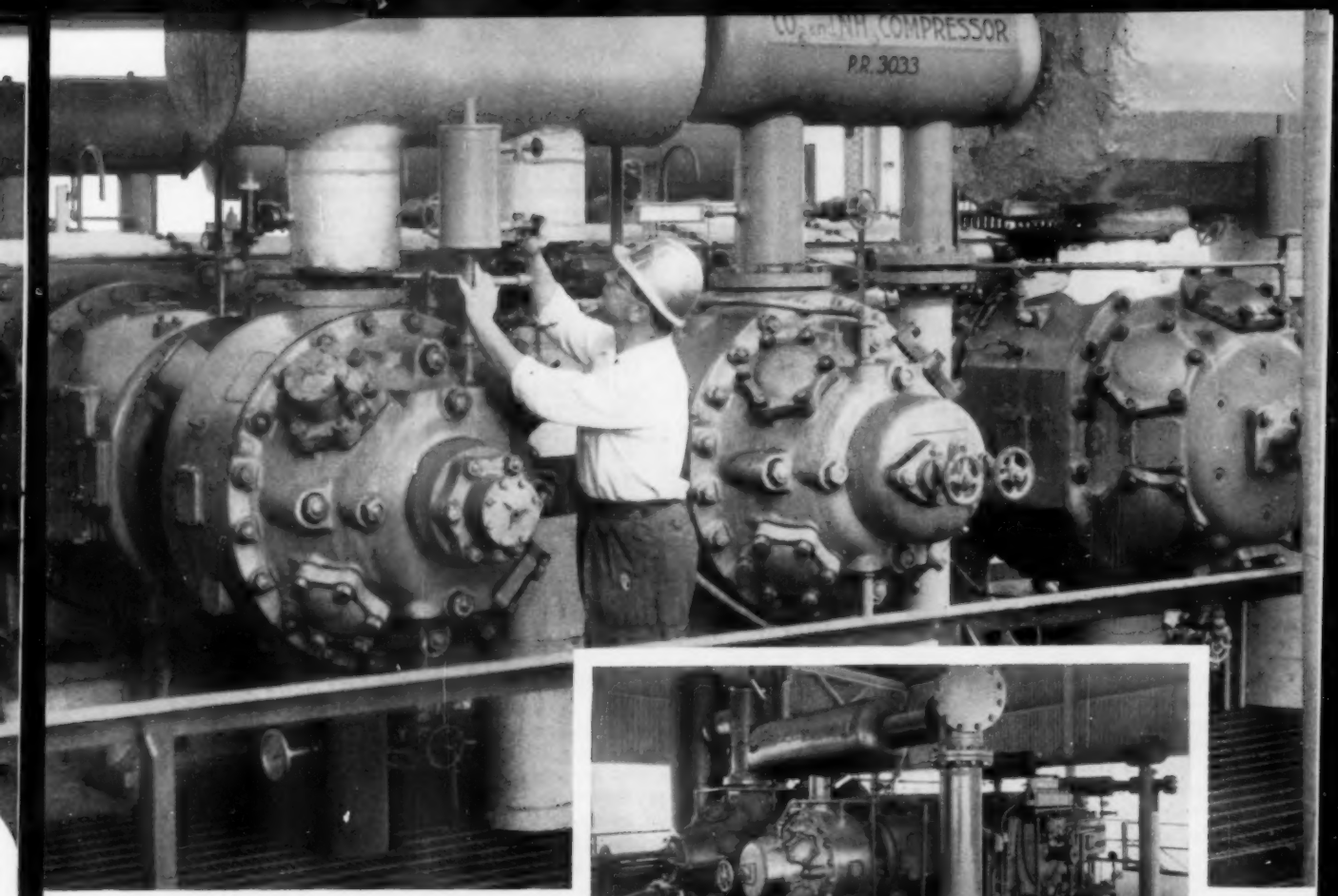

In the Lima, Ohio plant of Sohio Chemical this JM compressor handles CO_2 compression to 2800 psi.

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compression for CO_2 to 1200 psi for the forming of dry ice cakes and handling NH_3 for storage refrigeration. The second, also motor-driven, is a 4-cylinder JM rated 1250 hp at 300 rpm. This unit, compressing CO_2 for UREA production, handles pressures up to 2800 psi.

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ation. Table 1 shows results obtained from this type operation.

The percentage increase (Table 1) from this production method ranged from 3.9 to 117%, with the average on the 11 wells tested being 27.4%. The amount of gas used to lift liquids in this operation varies from 5 M.c.f. to 10 M.c.f. per bbl.

Plunger-Lift Installations

There have been several good papers written on the theory and principle of operation of plunger lifts. Reference is made to these articles at the end of this paper.

The most desirable type of plunger-lift installation is shown in Fig. 3. Here the tubing is produced to the sales line at approximately 500 psig. The plunger is inserted into the well by the use of a lubricator. The time-cycle controller with a motor valve shuts the flow line in and the plunger falls to the bottom of the tubing where a tubing-type stop has previously been set. At a predetermined time, ranging from 30 minutes to 1 hour, the surface controller will open the flow into the sales line, thus bringing the plunger and liquids accumulated above the plunger in the tubing string to the surface. The flow of gas then holds the plunger in the lubricator until the next cycle is repeated by the surface controller. Determination of the best cycle is a trial-and-error proposition until the optimum production is obtained. A typical orifice-meter chart of this type installation is shown in Fig. 4. On this particular well, production before installation averaged 629 M.c.f. per day. After installation, the production averaged 780 M.c.f. per day, or an increase of 24% per day. Table 2 is a summary of results from this type operation.

TABLE 3—GAS PRODUCED THROUGH CASING, LIQUIDS THROUGH TUBING BY PLUNGER LIFT

Well name—	Gas production, M.c.f. per day			Hydrocarbon production, Bbl. per day		
	Before	After	% inc.	Before	After	% inc.
6 Atlantic State	8	25	212.5	1.1	2.5	127.3
4 Barrett	294	388	32.0	3.5	4.2	20.0
7 San Juan 32-9	484	763	57.6	(*)	(*)	.....
17 San Juan 32-9	92	141	53.3	1.0	2.0	100.0
5 Newberry	110	196	78.2	1.0	1.5	50.0
3-A Jones	297	700	135.7	0.0	3.0	.....
3 Stewart	96	205	113.5	0.0	1.0	.....
1-A Elliott	111	207	86.5	0.5	1.0	100.0
3 Case	88	94	6.8	0.0	1.0	.....
2-A Stewart	84	262	211.9	0.0	2.0	.....
Average			98.8			79.5

*Liquid production not measured.

Field results satisfactory . . . The range of production increase (Table 2) is from 8.3 to 39.7%, the average being 21.9%. Liquid production increased 29.2%. Certain advantages obtained by this type of operation are:

1. Steady gas production is maintained without the waste of gas experienced by purging the well to the air to unload liquids.

2. The plunger acts as a scraper to keep tubing free of paraffin and other deposits.

3. By keeping the tubing free of paraffin, the necessity of cutting paraffin on a regular basis has been eliminated.

This type installation will not operate in all wells because the slow build-up in bottom-hole pressure while shut in.

Modification . . . For wells that will not operate by this method, the following operation is used as shown in Fig. 5. Here the gas is produced through the casing to the sales line. The annulus between the casing and tubing acts as a long separator with liquids accumulating at the bottom of the well bore. Through the use of a lubricator, time-cycle controller, and choke, the plunger is cycled up and down the tubing. With a casing-tubing volume ratio in the order of 5 to 1, a standing valve is used; and with each trip of the plunger, the liquid is transferred from the casing to the tubing as a result of the differential in pressure created as the plunger is moved to the surface.

As the plunger enters the lubricator, the automatic shutoff control actuates the time-cycle controller, thus shutting off the flow of gas. The plunger then falls back to rest on the standing valve. The standing valve retains the liquid that has been moved into the tubing during the previous cycle. This liquid is then moved to the surface during the next cycle of the plunger. Results obtained by this type installation are shown in Table 3.

The increased production ranged from 6.8 to 212.5%. The average increase in daily production was 98.8%. Liquid production increased 79.5%

Advantages of casing gas production over tubing gas production are as follows:

1. Liquid accumulation and friction loss held to a minimum, permitting higher gas-production rates which ap-

TABLE 2—GAS AND LIQUID PRODUCTION THROUGH TUBING BY USE OF A PLUNGER LIFT

Well name—	Gas production, M.c.f. per day			Hydrocarbon production, Bbl. per day		
	Before	After	% inc.	Before	After	% inc.
1 Barrett	907	998	10.0	8.9	8.9	0.0
2 Barrett	1,061	1,149	8.3	8.1	9.8	21.0
3 Barrett	616	735	19.3	6.5	7.0	7.7
1 San Juan 32-9	577	705	22.2	15.3	16.6	8.5
4 San Juan 32-9	869	1,165	34.1	15.7	21.8	38.9
5 San Juan 32-9	841	946	12.5	14.1	18.8	33.3
23 San Juan 32-9	573	661	15.4	1.4	2.0	42.0
4 Scott	572	650	13.6	1.4	2.4	71.4
5 Scott	1,018	1,306	28.3	15.0	16.0	6.7
1 Marcotte	1,653	2,021	22.3	30.4	39.2	28.9
2-C Riddle	1,000	1,145	14.5	5.6	7.0	25.0
29 San Juan 28-6	622	856	37.6	2.6	3.8	46.2
37 San Juan 32-9	591	826	39.7	(*)	(*)	.....
39 San Juan 32-9	630	820	30.1	(*)	(*)	.....
41 San Juan 32-9	1,204	1,435	19.1	(*)	(*)	.....
5 Newberry	629	780	24.0	1.0	1.5	50.0
Average			21.9			29.2

*Liquid production not measured.

proach the theoretical maximum possible.

2. Gas flow from the casing is at a low velocity, and a much cleaner and drier gas is produced. Gas flow is not greatly affected by liquid cycles, the result being a smooth flow of gas.

3. Liquid-lifting efficiency is maintained at a high level, with the ratio being from 1.6 M.c.f. to 3.5 M.c.f. per bbl. for the 5,000-ft. well.

New Developments

At this writing, a tubing valve that has been developed in the San Juan basin, is working to the satisfaction of the operators concerned. This valve is set in the bottom of the tubing above the tubing perforations and packed off. The tubing is vented to the atmosphere. Gas is produced through the casing and liquid accumulation in the casing is permitted to enter the tubing through a small orifice. As hydrostatic pressure overcomes the spring setting on the valve, the valve opens and gas pressure then unloads the slug of liquid. As the weight of the liquid is removed, the valve closes and the cycle is repeated. As yet, no actual conclusions can be drawn from this method of production.

Conclusions

No direct conclusions can be derived from the foregoing data because each well must be treated on an individual basis. Generally speaking, the following conclusions can be made:

1. Intermitters perform satisfactorily on Pictured Cliffs wells.

2. Intermitters must be used on Mesaverde wells that are open-hole completions because of the fact that these wells cannot be produced through the casing.

3. Mesaverde wells that produce above 500 M.c.f. per day and have trouble removing liquids can be helped by use of a plunger-lift operation producing gas and liquid through the tubing. This method does not waste gas by blowing to the atmosphere to remove liquids.

4. Mesaverde wells that produce under 500 M.c.f. per day and have trouble removing liquids, and provided that they are cased through the pay zone, can be helped by plunger-lift installation operating in the tubing to remove liquids. This method requires that gas used to lift the liquids be blown to the atmosphere, but the efficiency of lift is much greater than with intermitter applications.

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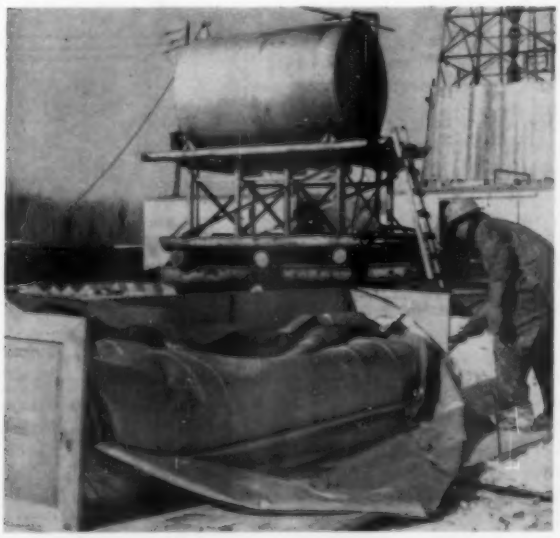

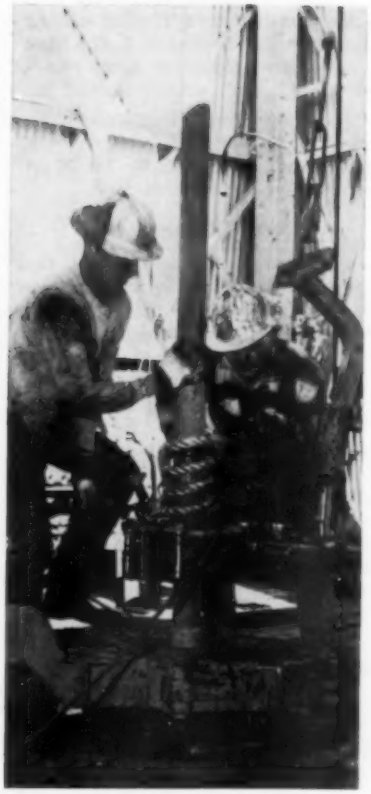

Here's a well which set records for gas drilling and coring and which paved the way for still more records. Magnolia's lessons will be valuable to anyone who drills in Southwest Texas or who drills deep with gas anywhere.

How to set a drilling record

BY ED McGHEE
District Editor

WHAT MAY BE one of the most important new gas reserves of recent years was opened up by Magnolia Petroleum Co.'s and Western Natural Gas Co.'s 1 Brown-Bassett in Terrell County, Texas.

The 1 Brown-Bassett is important for still another reason. It set the pattern for good drilling practices to guide all wells to follow in the area. It set a depth record for gas drilling. And, knowledge from the 1 Brown-Bassett paved the way for that record to be extended in a nearby well.

The 1 Brown-Bassett was drilled by Magnolia's company tools. While Magnolia is certain that it can drill future wells in the area still faster, the 1 Brown-Bassett was a record setter in itself. Fig. 1 shows how rotating hours on this well compare with Magnolia's 1 Morrison, completed nearby in Val Verde County in 1956. Both wells cut substantially the same geological section. Yet, the total rotating hours on the Brown-Bassett were only about 57 per cent as high as on the other well.

Gas drilling accounted for most of the improvement.

Notice in Fig. 1 that the two wells progressed about the same to the depth of 6,300 ft. Here the 1 Brown-Bassett began gas drilling and its drilling rate multiplied. When it was again necessary to use mud in the 1 Brown-Bassett, its drilling curve again came parallel to the other well which used mud all the way to total depth. When gas was used a second time, 1 Brown-Bassett's drilling time again showed a sharp improvement.

Hard rocks at the surface . . . One of the photographs shows the rocky, brushy terrain common to much of Terrell, Val Verde, and Pecos counties, Texas. The rocks at the surface are the outcrop of the Edwards lime which is extremely thick and hard here. The formation is so hard that

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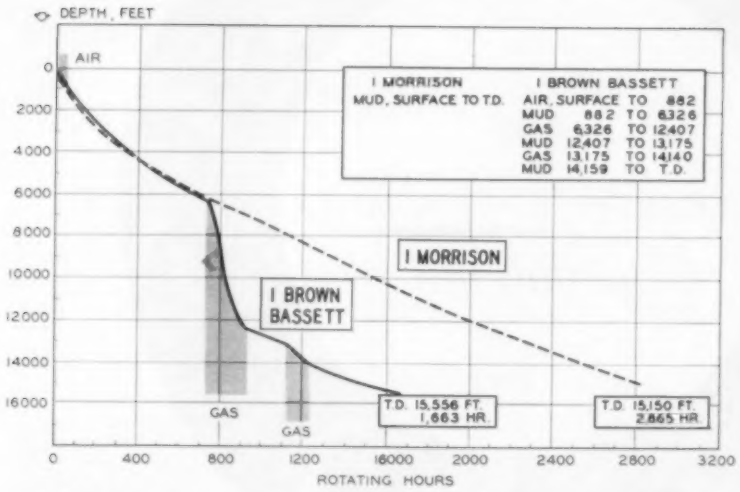

DRILL LOG for 1 Morrison and 1 Brown-Bassett wells in West Texas.

drilling the surface hole is often as difficult as drilling any other part of the hole. Of course, it's impossible to use heavy weights of long drill-collar strings at such shallow depths. So, drilling is slow. Besides, the hole sometimes tends to go crooked.

Magnolia successfully overcame these shallow-hole problems by air drilling. After setting 10 ft. of 20-in. conductor pipe, the company brought in six 520-cu. ft. per minute compressors. With the air compressed to 100 to 150 psi., drilling went quickly and smoothly down to 620 ft. At this point, the hole cut a water-producing sand. There was little enough water that it could be blown from the hole easily, but there was enough to make the bit cuttings pasty and sticky. This condition very often leads to sticking the drill string. To prevent this, Magnolia began injecting small quantities of water into the air stream at the surface. The added water was enough to dilute the cuttings-formation-water mixture so that it did not accumulate in the hole.

Injecting water at the surface worked well enough, but a little lower in the hole, the bit drilled into cavernous zone at 250 ft. (above the water). Even with air as the drilling fluid, there were no returns at the surface. So, Magnolia continued injecting small amounts of water at the surface and drilled without returns to 882 ft. Here, a string of 13⅜-in. surface casing was run and cemented.

Mud, then gas drilling . . . The company drilled out from surface casing (8,826 ft.) with mud and made normal progress to 6,326 ft. Here a string of 9⅝-in. casing was set. Feeling that most of the zones likely to contain water were now cased off, Magnolia turned to drilling with gas. An adequate quantity of gas was available nearby and was piped to the 1 Brown-Bassett.

All of the 8⅝-in. hole from 6,326 ft. down to 12,407 ft. was gas drilled. Formations in that interval are chiefly Pennsylvanian sands and shales with some lime. Table 1 shows just how successful the gas drilling proved to be. The control well in Table 1 is the 1 Morrison already mentioned. The geologic section cut was comparable in the two wells. In fact, formation tops were generally within 100 to 150 ft. of the same depth in both. About the only difference was that the 1 Morrison cut an 8¾-in. hole while the 1 Brown-Bassett cut an 8⅝-in.

As Table 1 shows, the Brown-Bassett made an average of 590% more hole per rotating hour. And it took only 9 bits compared to 135 in the other well.

There were no water or gas-bearing formations cut in the interval from 6,326 to 12,407. One core was taken; an 8⅜-in. diamond core head was used and 13 ft. of core recovered. Some 170 psi. of gas pressure was used when coring; in normal drilling at this depth, 150 psi. was sufficient. About 2.5 M.M.c.f. per day of gas was circulated.

Hole kept straight . . . Immediately above the 8⅝-in. bit, Magnolia ran a three-point roller reamer. Sixty feet higher, there was a three-point roller stabilizer. There were eighteen 6¾-in. drill collars and drill pipe was 5-in. Down to 10,000 ft. the rotary turned 55 r.p.m. and 15 to 20,000 lb. weight was carried on the bit. With this combination, the hole stayed within ½° to 1° of vertical.

At 10,000 ft., weight was raised to 30,000 lb. When a deviation survey at 10,250 ft. showed 2°, this weight was gradually lowered and finally dropped back to 10,000 lb. At 10,900 ft., deviation was 2½°; at 11,100 ft. it was 3°; and at 11,332 ft. it was 3¾°.

The reamer immediately above the bit was taken out of the string at 11,500 ft. In spite of this, the hole angle remained steady around 4°, reaching a maximum of 4¼° at 11,861 ft.

Casing head fails, rig lost . . . While the well was drilling ahead with gas at 12,407 ft., the bit topped a high-pressure gas zone. The well was shut in as soon as this formation gas reached the surface. Unfortunately, a leak developed in the casing head between the 9⅝-in. casing and the 13⅜-in. This 13⅜-in. then burst and the escaping gas caught fire. The entire rig was lost, with the exception of the engines, pumps, and compounds.

After killing the blowout and fire, Magnolia moved another rig onto the hole. And with a plug set in the 9⅝-in. casing, the company repaired the damaged casing head and casing. The drill pipe previously left in the hole was fished out and drilling resumed with a 10.4-lb. low-lime mud.

New hole was cut from 12,407 ft. down to 13,175 ft.; this includes 150

TABLE 1

Penetration rate (ft. per rotating hour):	Control well	1 Brown Bassett	Improvement per cent
6,300 to 7,000	5.4	20.0	270
7,000 to 8,000	4.8	35.7	640
8,000 to 9,000	4.4	58.8	1,240
9,000 to 10,000	4.9	47.6	870
10,000 to 11,000	4.5	37.0	720
11,000 to 12,400	3.6	19.4	440
Over-all average	4.4	30.5	590
Drilling bits:			
Conventional	13	2	....
Jets	118	0	....
Insert type	1	3	....
Insert-jets	3	4	....
Total	135	9	....

ft. of coring. Then, a string of 7⅝-in. casing was run to bottom and cemented.

Drying 13,175 ft. in one stage . . . In spite of the earlier loss of a rig, Magnolia had the courage to go back to drilling with gas. So, after drilling the plug on the 7⅝-in. casing with mud, the mud was displaced with water. This entire 13,175 ft. of water was blown out of the hole with gas in a single stage.

The gas-supply line to the rig had 1,150 psi. So, with the bit on bottom, Magnolia tied this pressure directly into the standpipe. When the gas had displaced all the water it could, the crew began pumping in water with a foaming agent added. As water was pumped in, the standpipe pressure naturally fell. And, more gas fed in automatically. The rate of gas input climbed until it was no longer necessary to pump in the water. Because of the foaming agent, water and foam came out of the well's 10¾-in. flow line with absolutely no heading.

The entire operation took only 8 hours.

Later, when it was necessary to load up the hole and change out the drill pipe, the drying operation was done in only 6½ hours.

Setting records with gas . . . Magnolia drilled with gas from the 7⅝-in. casing shoe at 13,175 ft. down to a depth of 14,140 ft. At the time, this was the deepest anyone had ever attempted to drill with air or gas. The present record of 14,759 ft. was set a few months later in a well only 6 miles away.

Magnolia cut a core from 13,782 ft. to 13,820 ft. This, as far as is known, sets a record that still stands for depth of air or gas coring.

Hole size was 6⅝-in. and Magnolia ran twelve 5¼-in. drill collars with no reamers or stabilizers. Drill pipe was 3½-in. With 10,000 lb. on the bit and the rotary turning 60 r.p.m., hole deviation remained low.

Only two insert-type bits were needed to drill the 1 Brown-Bassett from 13,175 to 13,650 ft. It took only five insert bits from 13,650 to 14,140 ft. In the same section, the 1 Morrison used 20 bits drilling and reaming.

When the 1 Brown-Bassett was drilling ahead at 14,140 ft., it began making formation gas. So, Magnolia mudded up the hole.

On to total depth . . . From 14,140 ft. to total depth of 15,556 ft., Magnolia used a 9.8-lb. lime-base low-solids surfactant mud. Temperature in the lower portion of the hole rose to 320° F. which is unusually high in West Texas drilling. However, there was no undue trouble on account of the temperature.

Magnolia ran 20,000 to 25,000-lb. weight on the bit and used fifteen 5¼-in. drill collars. In the last 1,416 ft. of hole (mud-drilled) 7 regular rock bits, 1 regular jet bit, and 15 insert-type jet bits were used.

At total depth, a 5½-in. liner was run on the drill pipe. It hung out of the 7⅝-in. casing string and extends to total depth. Completion was made in this liner.

Acknowledgment

Credit is due A. A. Diamond and Lane Larance, of Magnolia's drilling tool division, Midland, Tex., for supplying the information contained in this article.

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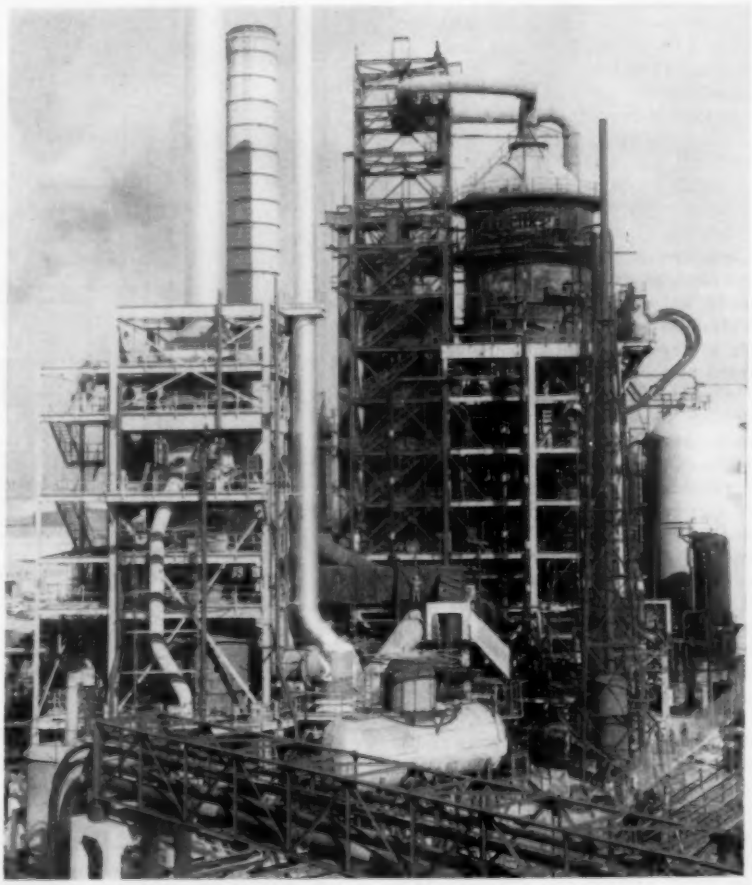
Frank J. Gardner, "Val Verde Offers 1,600 ft. of Ellenburger to Shoot At," The Oil and Gas Journal, February 17, 1958.

K-Values in Punched Cards

IN REVIEWING the work of the technical committee of the Natural Gasoline Association of America, Charles E. Webber, Sun Oil Co., Philadelphia, chairman of the association's technical committee, stated that the light-hydrocarbon vaporization equilibrium constants (K values) will be available to the petroleum industry in punched card form early this summer.

"The cards," he explained, "which fit IBM machines and can be adapted for use with other machines, will be punched with mathematical constants for the equations which represent the NGAA K values. These cards and a procedure of their use will be available from association headquarters by early summer. They will permit process design calculations for the whole petroleum industry to be carried out in seconds on computers."



NEW CO BOILER, at left in the photograph, has been installed at Utah Oil Refining Co.'s Salt Lake City refinery. The boiler is producing 138,000 lb. of steam per hour and a pressure of 310 psi. and a temperature of 540° F. Utah's fluid catalytic cracker handles 17,000 bbl. per hour of gas-oil charge. The refinery changes 30,000 bbl. per day of crude.

Three-Stage Separators Handle Two-Phase Flow . . .

from offshore wells

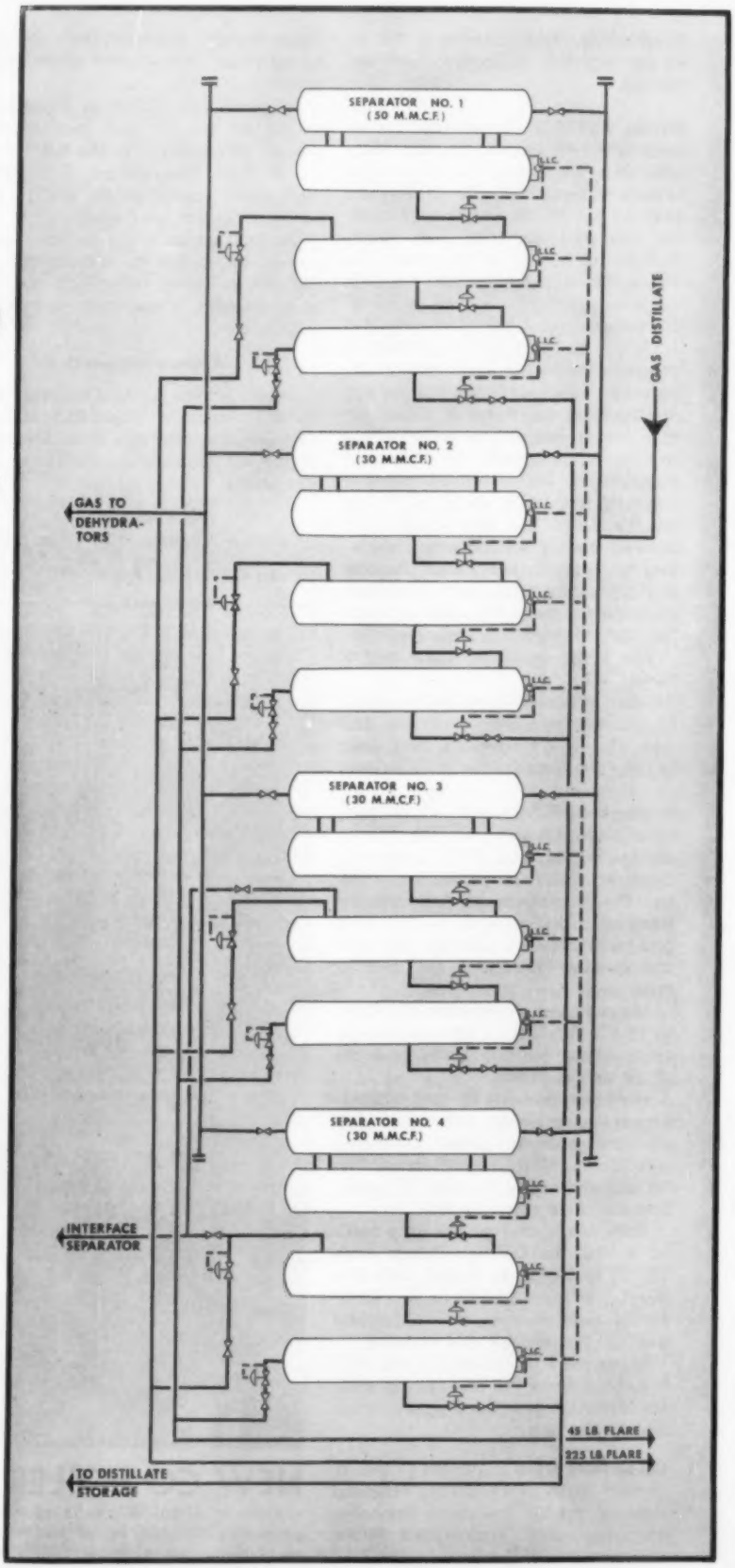
BY LARRY RESEN
Gulf Coast District Editor

FOUR separators, connected in parallel, are used to recover condensate from 135 M.M.c.f. of gas daily at Marine Gathering Co.'s separation station south of Lake Arthur, La. Condensate content of the two-phase stream reaching the plant averages 6-7 bbl. per M.M.c.f. of gas, with about 875 bbl. of liquids being recovered by the separators.

Marine Gathering (a subsidiary of Commonwealth Oil Co.), receives its gas-condensate stream from offshore wells in Rollover field, Block 39, Vermilion area. Pure Oil Co. delivers an average 85 M.M.c.f. to be separated and Phillips Petroleum Co. delivers about 50 M.M.c.f. This gas reaches shore through two lines, 8½ miles of 8-in. line and 9½ miles of 10-in. On shore the two lines are manifolded together and the wet gas is carried 7 miles through an 8-in. and 16-in. line. These two lines connect to a 20-in. line which runs another 20½ miles to the plant site. The seeming inconsistency of pipe sizes is due to the growth of capacity of the gathering system, with different sizes installed in some sections to take care of anticipated expansions.

In operation of its facilities, Marine Gathering does not pig its lines and is not faced with the problem of handling a large plug of liquid normally displaced by a scraper passing through the line. It does have the common task of handling high liquid volumes due to wells kicking or abnormal flow conditions. In this latter respect, especially high volumes of liquid are received by the plant when some of the wells are shut in for testing and then brought back rapidly onstream.

The increased flow of gas tends to



SEPARATORS are connected in parallel at Lake Arthur station.

The First HEXANE ISOMERIZATION

In a program to increase octanes of field distillate-derived motor fuels, Atlas Processing Company at Shreveport, Louisiana, has selected HUDSON to construct a normal hexane isomerization unit – the first contracted to be built. Low octane hexane will be fractionated from the total refinery feed stocks, and catalytically converted to high octane fractions to give substantial increase in octanes of finished gasolines.

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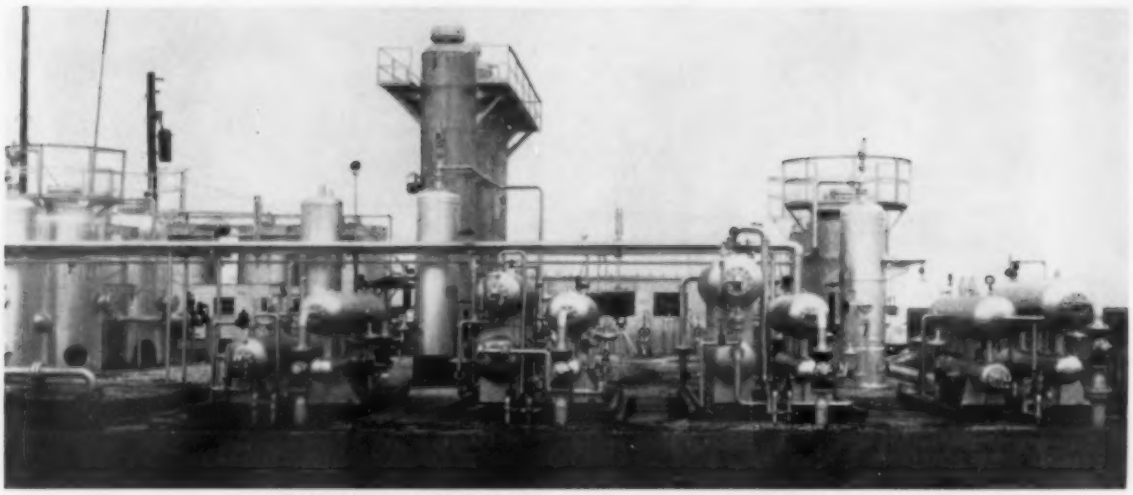


HORIZONTAL SEPARATORS feed off a common manifold.

pick up additional liquid from the gathering line and bring it into the plant. The maximum volume handled to date under these conditions amounted to 4,000 bbl., approximately five times the normal rate. This slugging occurred when flow was increased from 45 M.M.c.f. to 115 M.M.c.f. daily in a period of 12 hours.

Under these circumstances, Marine Gathering relies on the four three-stage separators to handle both the gas-condensate streams.

These separators are horizontal, off-the-shelf, National Tank Co. oil-field-type separators. One separator has a 50 M.M.c.f. per day capacity and each of the other three has a 30 M.M.c.f. capacity, providing a total gas-handling capacity of 140 M.M.c.f. per day. In order to insure that the incoming stream is distributed properly, the separators all feed off a common manifold with the incoming line tying into the center of the manifold at right angles. Distribution is quite important in handling the two-phase stream to avoid a concentration of liquid in one or two separators. Hence, the right-angle connection to the manifold, rather than having the incoming stream enter at one end of the manifold. Were this latter situation the case, the tendency would be for liquids to be concentrated in the separators tied to the far end of the manifold and essentially gas alone would be processed by the upstream separators. The central inlet point prevents this from taking place.

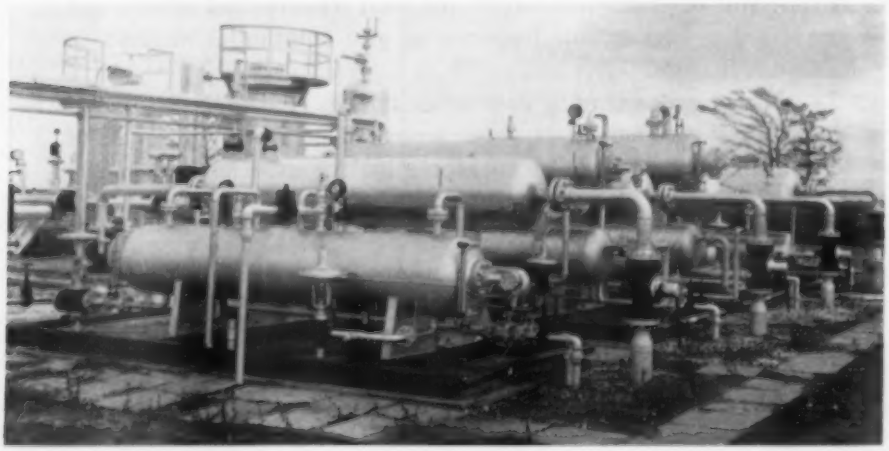
The four separators are not identical due to the progressive growth of the station with later models being added as the plant grew. However, they operate much the same. The first stage consists of two horizontal drums with the gas-condensate stream entering the top drum. Liquid is knocked out and drops to the lower drum and gas is pulled off the top drum to be sent to the dehydrators.

The liquid content of the lower drum is governed by a liquid-level controller, operating a 2-in. dump valve. Liquid is dumped to the second-stage, where gas is flashed off to flare and a liquid-level controller operates to dump the liquid into the third stage. Again gas is flashed to the flare system and liquid is withdrawn and sent to storage. The three stages operate at pressures of 1,000, 225, and 45 psi. respectively.

Parallel operation of the separators in this manner has been found satisfactory for handling total line flow. The relatively low content of condensate has not posed any problems. During the few times this slugging has occurred, the distribution of the stream across the four separators made it possible to handle high volumes of liquid without any undue effects. During these times, dump valves operated continuously, and for all practical purposes remained open during periods of high liquid recovery.

Acknowledgments

Cooperation of the management of Commonwealth Oil Co., Robert C. Ledford, vice president, and Kenneth Boyd, Lake Arthur plant superintendent, is gratefully acknowledged.



RIGHT - ANGLE CONNECTION to manifold avoids liquid concentration.

BP MAPS THE FUTURE

Children of Medina, the new township near Kwinana Refinery, outside their splendid modern school.

A new township springs up in Australia

SEVENTEEN MILES south of Fremantle, the main port of Western Australia, is Australia's biggest refinery – Kwinana – owned and operated by one of the British Petroleum group of companies.

Nearby a new township has risen amid the gum trees and casuarinas of the Australian bush. Named Medina, it has been built by the Western Australian authorities as the first part of a large new town to house many thousands of people whose livelihood will be mainly bound up with oil.

This new town has been planned not only for personnel of Kwinana Refinery, but also for employees of the new industries attracted to the area by the building of the refinery, with its ready supply of fuel oil and other products.

Kwinana started operating in 1955, and can now process 60,000 barrels of crude oil a day. Important new plant is at present being added to meet Australia's ever increasing demand for oil products.

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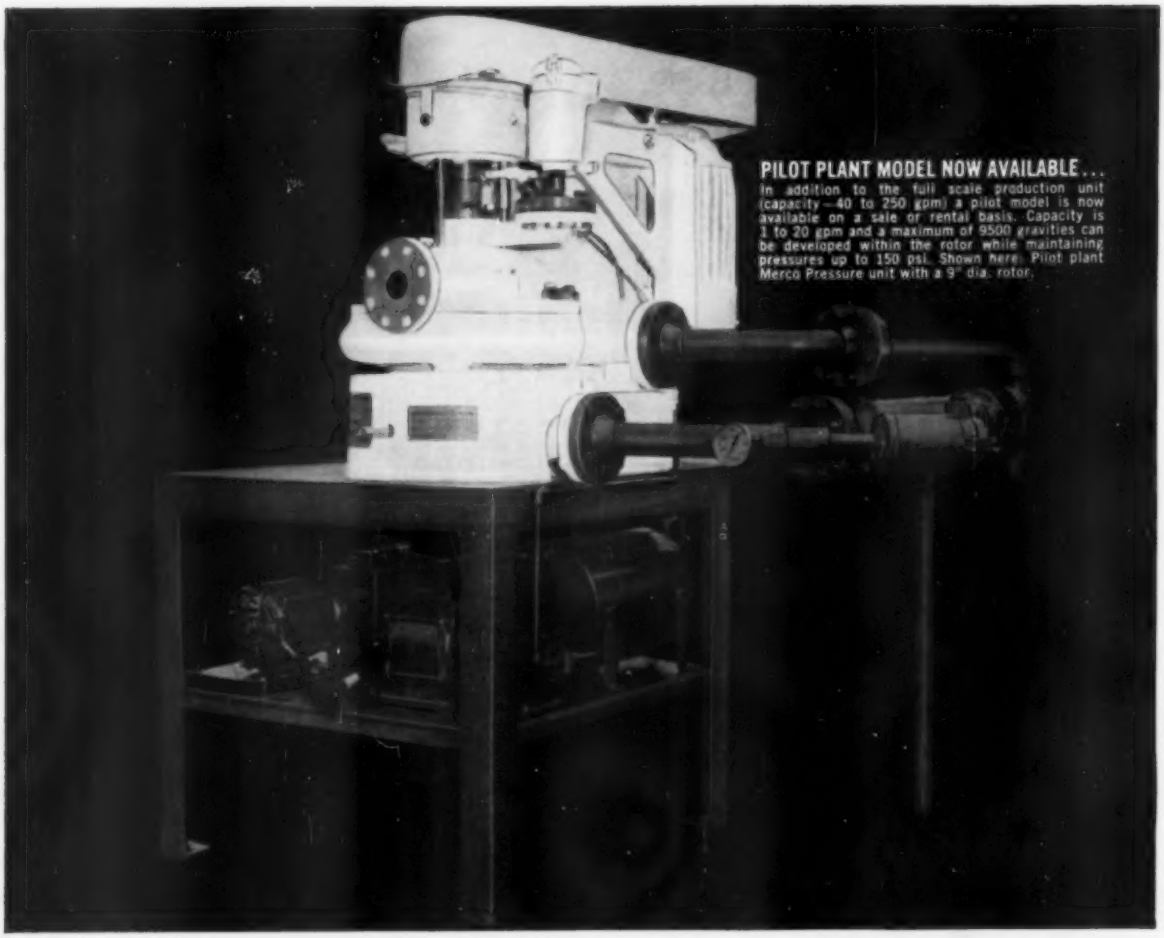
BY W. L. NELSON
Technical Editor and
Petroleum Consultant

Steam and electrical requirements since 1926 in average U. S. refineries

	Electricity, kw.-hr./bbl.			Cost of purchased electricity			Approximationof steam required, lb./bbl.			Refinery generation of electricity (approx.)	
	Purchased†	Generated in refinery*	Total used*	Index¶	Mills per kw.-hr.‖	Cents per bbl.	No lubes	Average refinery	Lube refinery	Pounds steam to generate 1 kw. hr.	Steam used in generating electricity, %
1926	*1.0	0.66	1.66	*108.0	9.2	0.9	130	197	500	100	33
1928	*1.0	0.78	‡1.78	104.5	8.9	0.9	130	194	480	...	35
1930	*1.0	0.78	‡1.78	106.0	9.0	0.9	130	186	460	...	36
1931	1.02	0.87	1.89	107.0	9.1	0.9	129	181	440	75	36
1932	1.03	0.90	1.93	113.5	9.65	1.0	129	176	420	...	36
1933	1.04	0.92	1.96	102.0	8.65	0.9	128	172	400	70	37
1934	1.14	0.93	2.07	*100.0	8.5	0.95	128	169	380	...	38
1935	1.11	0.93	2.04	*100.0	8.5	0.95	128	164	365	...	40
1936	1.12	0.94	2.06	*100.0	8.5	0.95	128	160	340	...	41
1937	1.11	0.96	2.07	*100.0	8.5	0.95	127	158	325	...	43
1938	1.20	0.98	2.18	*95.0	8.05	0.95	127	153	315	70	45
1939	1.265	0.98	‡2.24	*90.0	7.65	0.95	127	154	320	...	44
1940	1.30	1.02	2.32	*85.0	7.25	0.95	126	152	320	65	44
1941	1.32	1.03	2.35	*80.0	6.8	0.9	125	151	325	...	46
1942	1.53	1.11	2.64	*90.0	7.65	1.15	126	152	340	70	49
1943	1.70	1.22	2.92	*95.0	8.05	1.35	129	154	350	75	60
1944	1.835	1.35	‡3.18	95.5	8.1	1.5	130	155	360	...	64
1945	1.845	1.36	3.2	99.5	8.45	1.55	128	158	360	...	62
1946	1.655	1.51	3.16	106.5	9.05	1.5	126	154	340	65	64
1947	1.60	§1.49	3.1	104.0	8.85	1.4	126	149	320	...	65
1948	1.45	1.65	3.1	106.0	9.0	1.3	125	150	325	...	71
1949	1.635	1.77	3.4	110.5	9.4	1.55	124	147	325	...	75
1950	1.71	1.79	3.5	107.0	9.1	1.55	124	146	330	...	84
1951	1.70	1.8	3.5	104.5	8.9	1.5	123	144	334	70	87
1952	1.74	1.76	3.5	105.0	8.95	1.55	122	145	338	...	85
1953	1.85	1.75	3.6	105.0	8.95	1.65	122	142	342	...	86
1954	2.11	1.69	‡3.8	108.0	9.2	1.95	121	139	346	...	88
1955	2.25	1.60	3.85	103.0	8.75	1.95	121	139	350	75	86
1956	*2.45	1.45	3.9	100.0	8.5	2.1	121	140	354	...	78

*Estimated. †U. S. Bureau of Mines yearly statistics. ‡Stueve, W. H., "Buy Power or Make Your Own?" The Oil and Gas Journal, Dec. 24, 1956, p. 64. §Process Energy, Chem. Eng., May 1950, p. 103 (see page 109). ¶Wholesale Prices, Bureau of Labor Statistics, U. S. Dept. of Labor. ‖Nelson, W. L., The Oil and Gas Journal, Aug. 12, 1957, p. 131, "Average for Refining Centers of United States." See Process Costimating No. 14.



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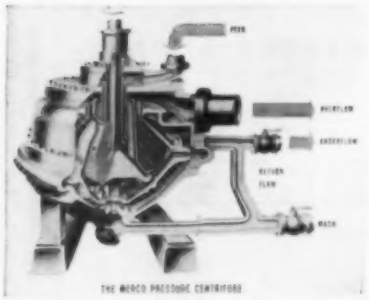

Illustrative drawing of a full scale Merco Pressure Centrifuge with a 30" dia. rotor bowl.

Latest addition to the Merco line of centrifugal equipment is the new Pressure Centrifuge. Originally developed for a catalyst removal step in the production of linear polyethylene, this new unit shows definite promise in a variety of refining and petrochemical applications.

Incorporating the unique return flow principle, this Merco can concentrate, wash, clarify, classify and recover soluble values . . . all at pressures up to 150 psi. There is no nozzle clogging nor solids build-up within the unit. The overhead drive eliminates the need for a submerged bearing; and a built-in, hydraulic hoist simplifies inspection and maintenance.

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Large-scale, single-plant operation is unusual when reclaiming . . .

Monoethanolamine solution

BY J. C. DINGMAN and R. P. MONAGHAN

MONOETHANOLAMINE - solution reclaiming has been practiced as a single large-scale operation using plant-size distillation equipment which is generally not common to the gas-treating plant.

These instances are unusual. Where they do occur, they must be considered as individual cases. This type of solution reclaiming is not of sufficient general interest to justify detailed discussion.

Monoethanolamine - solution reclaiming is most commonly done at the site of the gas-treating plant. A simple semicontinuous batch - type flash distillation is used and the equipment is usually an integral part of the treating plant. In discussing this continuous reclaiming, we should consider the equipment and trace the flow.

Reclaiming kettle . . . Fig. 1 shows the solution - reclaiming kettle to which is fed the monoethanolamine solution. Flow of this feed is controlled by liquid level. To reduce the heat load on the reclaiming kettle, solution feed to the kettle is taken from the reboiler on the solution stripper. Vapor is taken overhead through a demister to the solution stripper, where it is introduced in the vapor phase.

Authors are with Jefferson Chemical Co., Houston. From paper presented at California Natural Gasoline Association meeting.

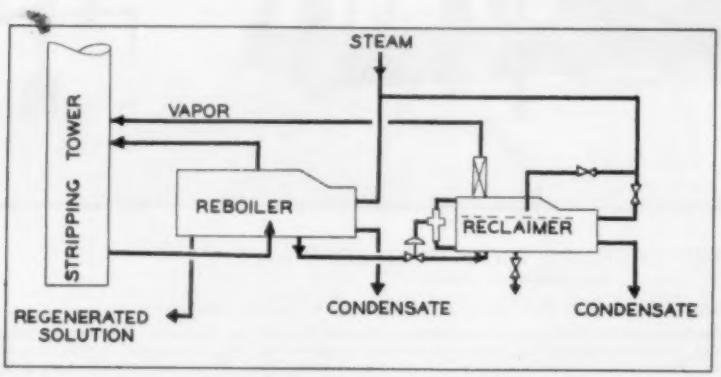
In some operations this overhead vapor is condensed and returned to the system in the lean amine stream. This procedure may be desirable where vapor loading on a stripper is high. For most operations, however, it is advantageous to return the overhead stream as vapor so that utility savings are realized.

It will be noted that no reflux other than internal is used. The demister functions to prevent carryover of entrained liquid from the kettle. There is no continuous removal of a bottom stream. The bottoms accumulate in the kettle and are dumped at the end of a cycle.

Sizing of the kettle will depend upon the volume of solution being treated. By rule of thumb, the kettle capacity should be about 75 to 100 times the feed to the kettle in gallons per minute. They may be reduced slightly on larger units.

The rate of feed to the reclaimer kettle is generally set at one-half of 1% of the rate of solution circulation. While this value may be increased for systems subject to fouling, it is seldom necessary to exceed a rate equal to 1% of the rate of circulating solution.

Thus, a system containing 25,000 gal. of solution circulating at a rate of 1,000 gal. a minute would have a feed rate to the solution reclaimer of 5 g.p.m. The reclaimer kettle would be about 400 gal. capacity. The entire charge of solution would be turned over in 3½ days.



RECLAIMER flow diagram. Fig. 1.

Kettle construction . . . The solution reclaimer kettle is normally constructed of carbon steel. The kettle-heater tube bundle, while sometimes made of carbon steel, is more commonly stainless steel; Type 304 generally being satisfactory. The liquid phase in the kettle is normally corrosive so that the stainless steel is preferred for these tubes, while the shell, being in cooler service, may be carbon steel.

While some kettle designs involve long, slender vessels, the authors feel that the more conventional configuration, that is, a vessel design having a nearly minimum surface-to-volume ratio is more desirable. This design makes for minimum heat loss, minimum liquid-in-vapor entrainment, and maximum protection against fouling of heating surfaces. A dead space below the heating coils will allow for the accumulation of solids and heavy material.

Kettle temperature is limited to about 300° F., since higher temperatures may result in the codistillation of undesirable materials. With some systems, it is possible to go to a slightly higher temperature. The stream supply to the heater coils must, therefore, be 170 to 190 psig.

Steam spargers . . . These are built into the kettle to provide a second source of heat for use in the last stage of the reclaiming cycle. In this last stage, the solution feed to the kettle is shut off, and the kettle heated to recover the maximum amount of monoethanolamine. During this operation, liquid level can be maintained by addition of water or by the addition of steam through the steam spargers mentioned here.

The authors believe that the use of steam spargers increases the efficiency of the stripping operation and reduces corrosion by cutting down the time required for the last stage of the reclaiming operation and by providing agitation at a time when natural agitation by convection and boiling action is low. The steam supply for the spargers should also be 170 to 190 psig.

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MODERN DRILLING

Lubrication and slack wire:

Two problems in wire-line spooling

LUBRICATION is a factor frequently overlooked by even the best operator.

It is absolutely impossible for any manufacturer of wire rope to lubricate a rope sufficiently during fabrication to last for the expected life of the rope. A wire rope is a machine. Each wire and each strand in this machine must move in relation to each other.

Lubrication allows this condition to occur easily. Also, lubrication prevents corrosion by protecting the steel wires from rust or attack by corrosive fluids. A rustbound or locked rope quickly fails from fatigue.

Lubricate the rope periodically with lubricants designed for field applications of wire rope. If this is not convenient, a heavy grade of motor oil works very satisfactorily. It is suggested that the oil, SAE 50 or heavier, be brushed on the rope as it is being spooled onto the reel. This is particularly important if the equipment or rope is to remain idle for any period of time.

Slack Line

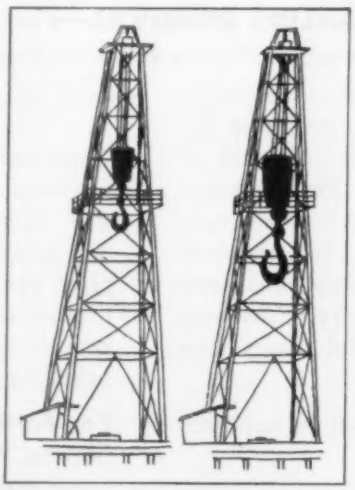
With the line spooling perfectly on the drum and sufficient weight being used in the block, hooks, and elevators, the line can still be spooled too loosely on the drum core. If slack line appears in the spooling system, it occurs when the operator is going back in the hole with a sharp bit.

The block, hooks, and elevators are speedily hoisted to the derrick man so that the elevators can be latched onto the double or thribble. Speed in this operation has always been emphasized in rotary drilling, and the hoisting equipment is light loaded, so as to speak.

Rotary-drilling hoist operators should always devise and practice a method for this operation so that no slack line whatsoever comes into the wire line as it is spooled on the drum. Even though the rig operator has the best spooling system available, there are times when the whole spooling operation is placed at a distinct disadvantage because of the manner in which the rig operator raises his elevators to the derrick man when they are unloaded.

If the clutch and brakes are not handled properly, he will throw an excess amount of slack line between the drum core and the fast sheave on the crown block. In some cases, this excess slack causes the loosely spooled line to jump two or three wraps leaving a gap.

An important suggestion for keeping slack line from forming on the drum is for the rig operator to throw out the clutch a moment before taking his foot off the engine throttle. This lets the hoisting drum coast at traveling-block speed.



PROPERLY CONTROLLED weight on blocks and hooks is important.

Taken from LeBus-International Engineers, Inc., wire-line-spooling handbook.

Satisfactory line service can be obtained only on drums with properly engineered grooving. The first duty of any groove is to spool the line properly.

The next important factor is to hold the proper centers on the line to accommodate the spooling of new line on worn line. No spooling job can be obtained without the proper tension to accommodate spooling. The tighter the wire is spooled the better the spooling and the longer the wire-line life.

The job conditions largely determine the amount of weight that can be used with the system, but we emphasize the importance of block and hook weight as it is used with controlled counterbalance spooling systems.

It is a foregone conclusion and has been proven on thousands of rigs and hoisting units that properly controlled weight on the block and hooks will always help the line spool better on a grooved drum.

Drilling rig and crane operators have contributed information set forth in Table 1.

TABLE 1—WEIGHT CONTROL

Max. drilling depths	Line sizes	No. of lines	Rev. weights comb. (lb.)
7,500	1-1⅛	6	8,000
		8	10,000
7,500-10,000	1⅛-1¼	8	12,000
		10	17,000
10,000-14,000	1⅛-1¼	8	20,000
		10	25,000
14,000 up	1¼-1⅜-1½	8	25,000-30,000
		10	
Industrial Cranes			
40-ft. boom	½-⅝	2	350
60-ft. boom	½-⅝	4	550
80-ft. boom	⅝	6	750
Gantry Cranes			
	⅞	5	6,000
	⅞	8	8,000

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For Further Information — Write Process Section Warner Lewis Company, Division of Fram Corporation, Box 3096, Tulsa, Oklahoma, for Process Manual on water separators/filters. Warner Lewis representatives are located throughout the United States and Canada and they will be glad to contact plant processing and operating personnel.

These formulas can help you

Size blowdown lines

to handle simultaneous discharges

BY FRANK LIPINSKI
Hydrocarbon Research,
New York City

THE SAME procedure as outlined in a previous article in this series may be used to size blowdown lines to handle the simultaneous discharges of more than one relief valve. Consider the system as shown in Fig. 3.

For Line L_3:

Assume P_o = psia.

$$G_{cnl} = 100 \times 144 \times [(32\times18)/(2.718\times1,546\times126)]^{1/2}$$

$$G_{cnl} = 149$$

$$G = \frac{70,000}{3,600} \times \frac{1}{0.785 \times 100/144} = 35.6$$

$$G/G_{cnl} = 35.6/149 = 0.239$$

$$\text{Velocity } U = \frac{70,000}{3,600} \times \frac{1}{0.133} \times \frac{1}{0.785 \times 100/144} = 160 \text{ ft./sec.}$$

$$Re = DUP/\mu = 10/12 \times \frac{160 \times 0.133}{0.016 \times 0.000672} \times 1.98 \times 10^6$$

$$f = 0.0032$$

$$P_B/P_J \text{ or } P_3/P_o = 14.7/100 = 0.147$$

At $P_3/P_o = 0.147$ and

$$G/G_{cnl} = 0.339, \quad N = 43$$

$$50 = 4 \times 0.0032 \times L_3'/(10/12)$$

$$= 2,800 \text{ ft.}$$

$$L_3' - L_3 = 2,800 - 500 = 2,300 \text{ ft.}$$

At $L = 2,300$ ft., $N = 36.3$

$$P_J/P_o = 0.48$$

$$P_J = 48 \times 100 = 48$$

$$P_J = 48 \text{ psia.}$$

For Line L_2:

P_o = 100 psia.,

$$G_{cnl} = 100 \times 144 \times [(32\times18)/(2.718\times1,546\times126)]^{1/2}$$

$$G_{cnl} = 149$$

$$G = \frac{10,000}{3,600} \times \frac{1}{0.785 \times 36/144} = 14.2$$

$$G/G_{cnl} = 14.2/149 = 0.095$$

for P_J/P_o or $P_3/P_o = 48/100 = 0.48$

At $G/G_{cnl} = 0.095$ and

$P_3/P_1 = 0.48$, $N = 260$

At $N = 260$, $L_2' = 10,800$

At $L_2' - 2,000 = 10,800 - 2,000 = 8,800$ ft.

$N = 216$

and P_{B2}/P_o or $P_3/P_o = 0.63$

$P_{B2} = 0.63 \times 100 = 63$ psia.

For Line L_1:

P_J/P_o or $P_3/P_o = 48/1,000 = 0.04$

$G/G_{cnl} = 0.13$*

At $P_3/P_1 = 0.03$ and $G/G_{cnl} = 0.13$,

$N = 160$

At $N = 160$; $L' = 37,500$ sq. ft.

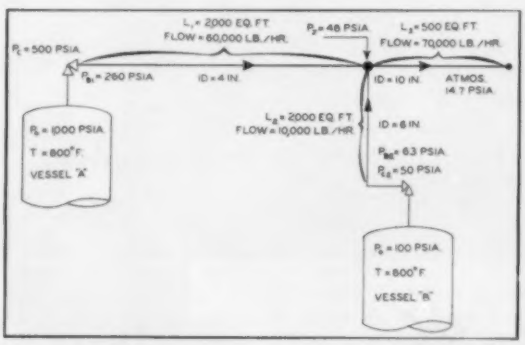
At $L' - 2,000 = 37,500 - 2,000 = 35,500$

$N = 152$

At $N = 152$ and $G/G_{cnl} = 0.13$

$P_{B1}/P_o = 0.260$

$P_{B1} = 0.260 \times 1,000 = 260$ psia.

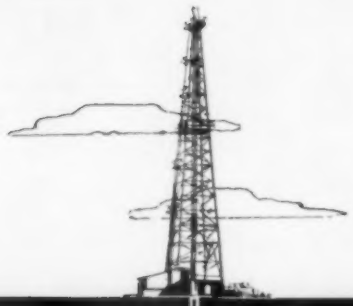


SYSTEM having simultaneous discharges of more than one relief valve. Fig. 1.

It can be seen that if there is a simultaneous discharge from both relief valves from vessels A and B, the back pressure for vessel B relief valve will be higher than the critical. This relief valve will not have sonic velocity in its throat and must be sized accordingly. Both relief valves must be balanced bellows type so that the back pressures developed will not affect the set pressures.

By continuing the same type of calculations, the pressure at any point in the piping system may be determined. **End.**

*From problem in Fig. 1, Part 1, p. 128, The Oil and Gas Journal, April 14.



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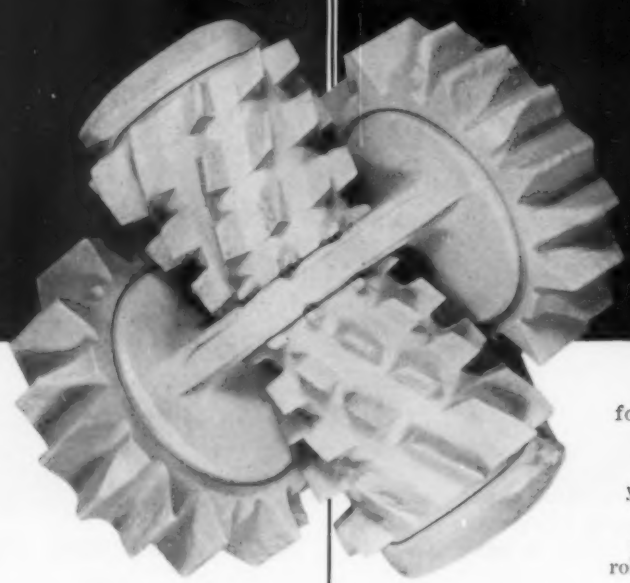

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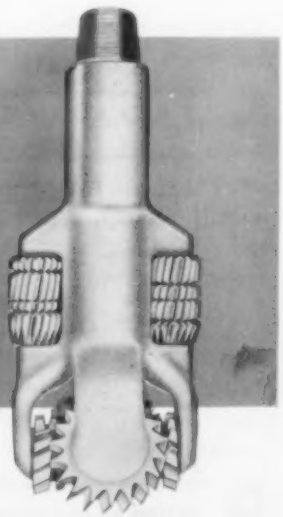

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Special rig is almost to 20,000-ft. mark in Oklahoma

A SPECIALLY DESIGNED rig is nearing the 20,000-ft. mark in drilling Shell Oil Co.'s No. 5 Rumberger, a wildcat test of the formations lying beneath the rich Elk City pool in Beckham County, Oklahoma.

Original contract depth for the well was 17,500 ft. but progress is still being made at 75 ft. per day. Shell set an intermediate string of 9⅝-in. casing at 11,515 ft., and an 8¾-in. hole is now being drilled by the Helmerich & Payne, Inc., rig on its first location.

Designed particularly for deep drilling in the Anadarko basin, the rig can put 2,100 actual horsepower into draw works and main mud pumps with its three engines. With a 250-hp. independent rotary drive and independent mud-mixing pump as well, the rig is in the 20,000-ft. class.

Behind the draw works, the rig is stepped down with a compound taking power from the three-engine-drive level.

With this split-section compound, the power units and drive equipment are easily portable. Intermediate and rear sections carry pump drive sheaves for the pair of 700-hp. pumps, and the front section the power input sprocket and dual Air-Flex master clutch for power to the draw works.

The main pumps and the mixing pump were used in series when Dresser's mud-powered turbodrill was tested on the hole in September of last year. With the high-torque engines, 876 gal. of mud were put down the hole each minute as compared to the usual 550 g.p.m. required when using conventional bits.

Balanced to the size of the draw works and engines, the rig includes a derrick rated for 1,000,000 lb. and substructure at 1,400,000 lb. The overhead string is equally heavy with a 1⅜-in. 7-sheave, 580-ton crown block, 1⅜-in. 6-sheave 480-ton traveling block, and 450-ton hydraulic-cushion hook.

THREE gas engines provide 2,100 actual horsepower for this rig and mud pumps. The rig is pushing to 20,000 ft. on a geological wildcat near Elk City, Okla., Shell Oil Co.'s 5 Rumberger well.

Who's getting the drilling contracts?

Santa Fe Drilling Co., Santa Fe Springs, Calif., has the contract on a directional well Union Oil Co. of California will drill from a surface location on the Paramount Pictures Corp. movie lot in Hollywood. Plans call for a 5,000-ft. test with bottom about ⅜ mile southwest. A soundproofed rig will be used. The location is in an area once included in the old Salt Lake and Los Angeles City fields where most of the production has been from depths of less than 1,000 ft.

Exeter Drilling Co. has contract for a Morgan County, Colorado, wildcat. It is the H. L. Hunt 23 Huey in C SW SW 28-2n-56w. Location is in the Denver basin.

Lewis Drilling Co. has contract for a Grail field well in Weld County,

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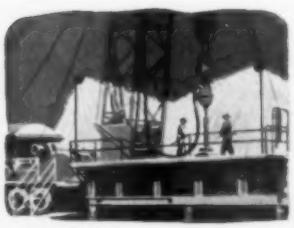

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Denver basin, Colorado. The "J" sand Dakota test is Pure Oil Co. 1 Doll-B, E½ SE SW 14-7n-58w.

Exeter Drilling Co., Dallas, has contract for a Denver basin wildcat, Raymond Oil Co. 1 Herbold Sheimer, C SE NW 18-14n-51w, Cheyenne County, western Nebraska. The well is a Dakota test.

Ashby Drilling Co., Dallas, is holding contract for British-American Oil Producing Co. 1 Colorado "W," a Logan County wildcat in the Denver basin. The well is located in C SE NW 3-10n-53w, and was spudded April 5.

HLM Drilling Co. has contract for a Skull Creek test in West Bijou field, Morgan County, Colorado. The well is Thanes & Turnbull 1 State, C SW NW 5-4n-59w. This field is one of the hottest new areas in the Denver basin. Production is from the "D" and "J" sands.

Butler-Johnson, Inc., Shreveport, has contracts for an extension test on the north flank of Holly Ridge field in Tensas Parish, and for a deepening operation of a southeast flank well in Ada field, Bienville Parish, Louisiana. At Holly Ridge the well is John W. Olvey, Jr., 1 Allen-Baker unit, located a half mile northwest of Wilcox production. Projected depth is 8,500 ft., or to the Tuscaloosa. The drilled deeper is Southwest Natural Production Co. 1 Thomas Youngblood unit, which will be carried from 8,000 to 9,000 ft. to test deeper sands in the Travis Peak formation.

Exeter Drilling Co., Dallas, has contract for a Downer field well in Banner County, western Nebraska. The Denver basin well is Sunburst Petroleum Co. 1 Jensen, C NW NW 3-18n-56w.

Garvey Drilling Co., Great Bend, Kansas, has contract for a wildcat in Kimball County, western Nebraska. The Denver basin wildcat is Petroleum, Inc., 1 Podoll, C NW SE 1-12n-57w.

Wakefield Drilling Co. has contract for Joe Champlin's projected 5,800-ft. stepout test to Plains field in Meade County, Southwest Kansas. The 1 Collingwood is in C NW SE 21-32-30. The operators are digging cellar and pits.

Continental Drilling Co., New Orleans, has contract for Union Oil Co. of California 22-B LL&E Co., a 10,000-ft. test in the Lake Hatch area, Terrebonne Parish, Louisiana.

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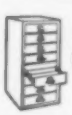

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Who picks up the tab for LACT?

BY GENE KINNEY
Assistant Pipeline Editor

PIPELINES should not be required to make any investment for lease automatic custody transfer (LACT). The producer should buy all equipment. . .

Pipelines should install all equipment which performs functions for which they are responsible according to customs established under conventional transfer of crude from lease tanks to pipeline . . .

The investment responsibility cannot be settled by any hard and fast rule. It must be arrived at by mutual agreement of producer and pipeline in the interests of reducing capital and labor costs and increasing accuracy to benefit the whole industry.

These widely divergent views were aired by members of a panel composed of producing, pipelining, and refining representatives appearing before the Pipe Liners Club of Tulsa. The discussion was made lively by the fact that millions of dollars in investment is at stake in these issues. There will be 99 installations in operation in the United States and Canada by July, according to an API survey (OGJ, April 7, p. 133). These units are handling less than 2½% of U. S. and Canadian production. While growth the past year has been rapid, the rigid positions of producers and pipelines threaten to limit LACT.

LACT PANEL is introduced by H. T. Chilton, Service Pipe Line Co., program chairman, standing. D. H. Chrislip, Kerr-McGee Oil Industries, Pipe Liners Club of Tulsa president, is at extreme left. Panelists (left to right) are F. H. Rhees, Sinclair Oil & Gas Co.; H. L. Shatto, Shell Oil Co.; C. T. Carter, Sinclair Pipe Line Co., moderator; G. G. Hebard, Phillips Petroleum Co.; H. T. Fuller, Magnolia Petroleum Co.; and R. A. Hamill, Service Pipe Line Co.

Producer's Viewpoint

F. H. Rhees, vice president, Sinclair Oil & Gas Co., Tulsa, took the conventional producer position on the question, "Should a pipeline furnish any investment for LACT?" He said that the meter should belong to the pipeline. It's the purchaser's business to own measuring equipment when meters are used, he reasoned, and the pipeline is the purchaser's representative.

He added a personal view that if he were a producer and a pipeline couldn't afford a meter where LACT was attractive, he would buy the meter. All other equipment should be the producer's investment.

Rhees said that the progress which is promised through LACT overshadows the issues of who pays for what. When LACT can be applied economically to leases of 5 to 20 bbl. per day (the breakeven point for a meter system has been estimated at 250 bbl. per day), then the importance of who makes the investment is small.

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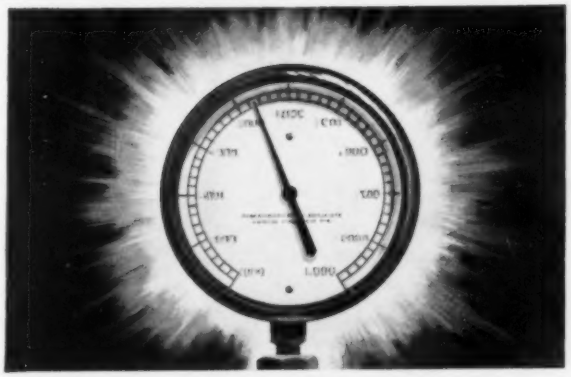

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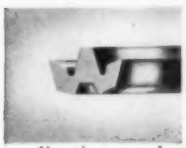

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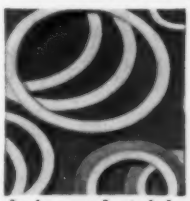

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G. G. Hebard, assistant to the chief production engineer, Phillips Petroleum Co., Bartlesville, said there is a logical and simple division of responsibility which has been established over the years. The pipeline now straps the tank, establishes calibration, gages producer tanks, records gross volume, uses pipeline equipment to determine temperature, thiefs tanks for b.s. and w., determines whether the oil is merchantable, and—if acceptable—puts the oil on the line and turns in a ticket. The producer treats oil to remove water, supplies tankage, piping, valves, and facilities for retreating.

Under LACT in a dump-tank system, Hebard said, the pipeline should calibrate the tank, supply data-handling and monitoring equipment, and the pipeline pump. The producer should provide treating, surge tanks, piping, controls on the dump tank, recirculating pump, central control panel, failsafe equipment, lease controls, and overflow tank.

In a p.d. meter LACT installation, the pipeline should still buy the data-handling equipment (the meter) and should calibrate the meter. The producer should provide treating, surge tank, transfer, and recirculating pumps. Each should simply continue to provide the counterpart to equipment for which he is responsible under the existing system. The pipeline furnishes data-handling equipment, monitoring, and sampling, which would amount to $2,000 to $2,500 in a $12,000 system.

H. L. Shatto, senior mechanical engineer, Shell Oil Co., Houston, declared neither party should foot the entire bill. On a meter installation, he pointed out that the meter, sampler, and monitor which the pipeline might logically buy amounts to $1,500 to $2,000 on a 1,000-bbl. per day unit, or one-fourth to one-third the total cost of $7,000 to $8,000.

The remainder of the investment is for emergency storage and diverting valves. The pipeline should pick up part of the tab where it stands to gain. It can't save on distribution of gagers until several units are in an area. In some areas (small scattered leases which have high per-barrel gaging costs) the pipeline may benefit most. LACT investment sharing should be a give-and-take proposition with the formula in a given situation arrived at by mutual agreement. The meter, sampler, and monitor should be controlled by the pipeline.

Pipeline's Answer

R. A. Hamill, chief gager, Service Pipe Line Co., Tulsa, taking note of producer concern that accuracy required pipeline ownership and control of the meter, commented wryly, "The meter doesn't know who bought it."

J. R. Polston, vice president of operations, Service Pipe Line Co., said that the producer's position was logical in theory but would not work in practice. The producer stands to reap a disproportionate share of the dividends. Service is connected to some 9,000 leases and 42,000 wells. With the total cost of LACT units as much as $10,000 to $18,000, Service's share of investment under producer proposals would be enormous compared to the saving promised.

If LACT were sufficiently widespread in an area, then it would make sense for a pipeline to consider dividing the expense. The only savings a LACT unit would provide to a pipeline company is in gaging costs.

The average production per lease is something less than 75 bbl. per day and the average depletion rate runs from 8 to 10% per year throughout the life of the average profitable producing field.

Any investment in a LACT unit must be paid out by savings in gaging costs based on average production for a 10-year period and still provide a 7% profit on the investment to a common-carrier pipeline. This obviously limits the extent to which a pipeline can participate in investment of LACT units. Also unless LACT units are installed in an area equivalent to a gagers' district there would be no savings to the pipeline.

Hamill said it would be attractive to pipelines where thixotropic crude is involved, where there is thermal adhesion in the tank, no level liquid measurement, and losses are such that the pipeline can't stay in business. Meters would be the only practical measuring method. The volume which would be required for an economic installation would depend on the per cent of crude loss suffered by the pipeline.

Hamill said that 70% of the oil gathered by Service cost 1 cent per barrel or less to gage. If the company laid off all gagers, it could reduce the tariff less than 1 cent per barrel. Gaging is costly for the remaining 30%. Rhees interjected that it was this 30% that should be worked on to save the 5 to 15-bbl. leases that pipelines are pulling away from. They need to be produced so that the reserves aren't lost.

Hamill said that he hadn't been able to see that the pipeline could gain much in a situation where the producer has an immediate payout on tankage while the pipeline has a payout in 15 years—if the lease is still

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producing. He said the pipeline should supply the pump, power, and sampler only. He does not want to have any appurtenances on the producer's property or to switch valves on producer's equipment or turn oil to his heater treater. He warned against the danger of retreating from recommended accuracy by proving meters by manual-gaging methods.

Hamill suggested that small producers organize associations and meter oil to a central place for delivery to pipeline, thereby saving tankage and giving the pipeline a volume that will permit it to remain in business in a stripper area. LACT throws the stripper area in a worse light than ever otherwise.

Hebard said isolated moves in this direction have been made. Rhees said he could visualize 5, 10, and 15-bbl. leases eventually on LACT.

Pipeline Interchange

When there is an interchange between carriers, who owns the meter or tankage? The receiving carrier should furnish tankage. There is no set policy on meters. It depends on which party has the greatest incentive.

H. T. Fuller, of Magnolia Petroleum Co.'s refining division, Beaumont, said his company has a flexible policy on meter ownership. Individual deals are made. Sometimes Magnolia buys meters and sometimes its customers who receive delivery own them. Magnolia has adopted meters extensively because it has found the error is far less than in hand gaging which is employed in loading vessels at Beaumont, even with expert gagers.

At refineries, shouldn't the refiner as purchaser own the meter? Who owns piping between the meter and tanks? And who's responsible for operating refinery gate valves on the downstream side of meters?

Fuller said that Magnolia's Beaumont refinery receives oil by meter from its affiliated pipeline and the pipeline owns the meter. The refinery owns the line and tankage downstream from the meter. Refinery pumping personnel handle valves downstream of the meter.

Meters often save the refiner considerable tankage. Is it proper for the refiner to participate with the pipeline in the meter expense?

Fuller said that meters had saved Magnolia 40% on related refinery tankage and the refinery department didn't share the expense of the meters.

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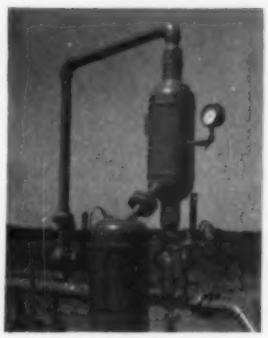

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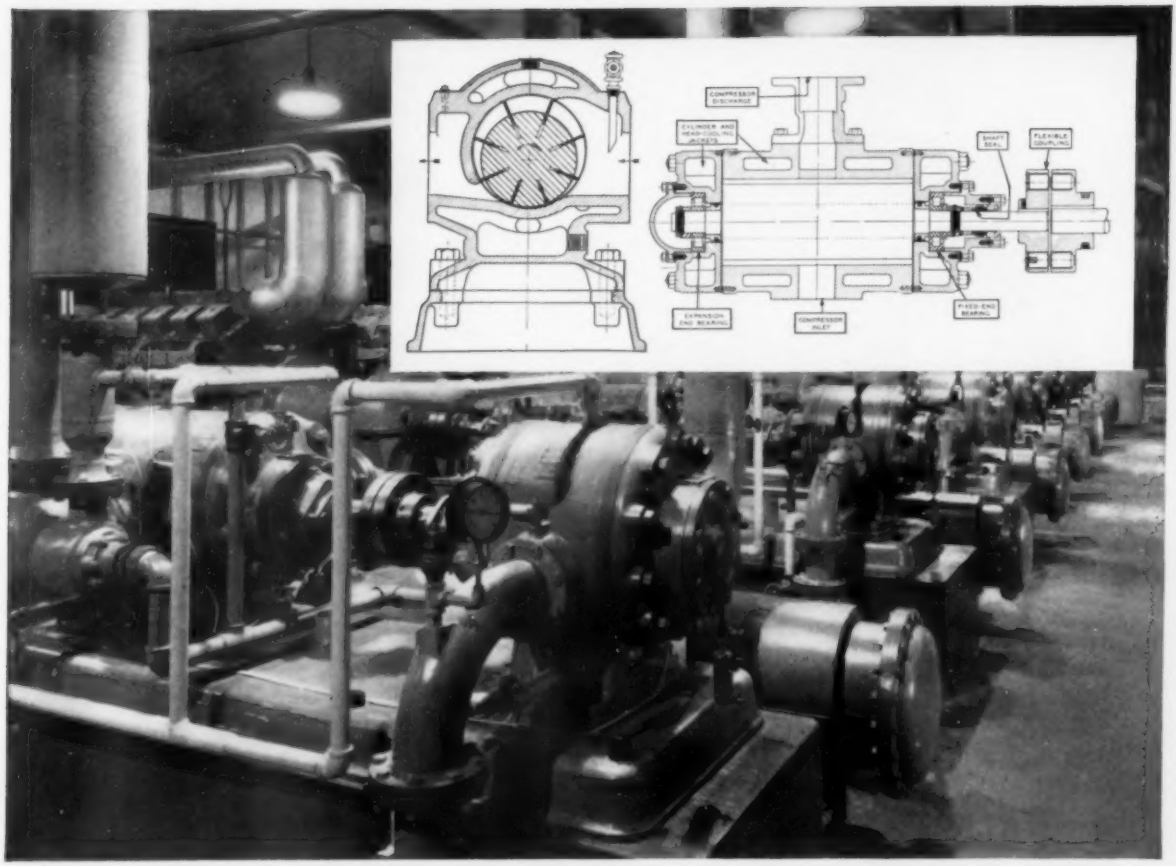

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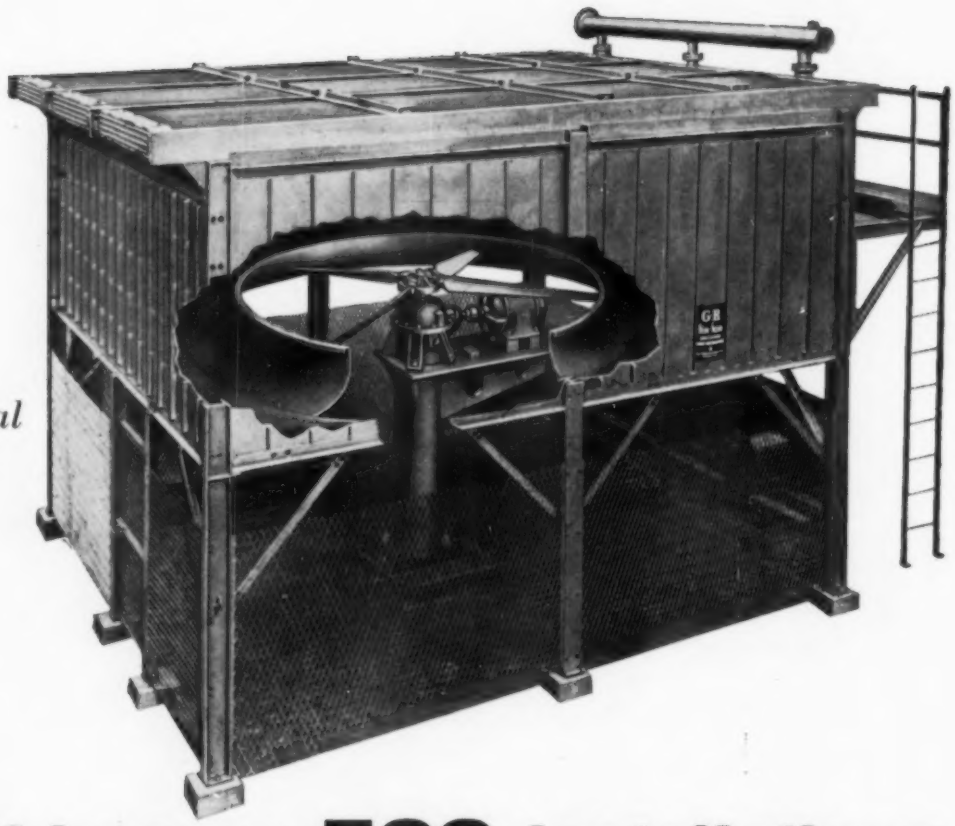

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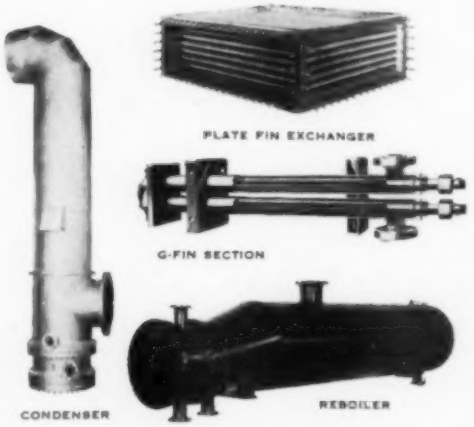

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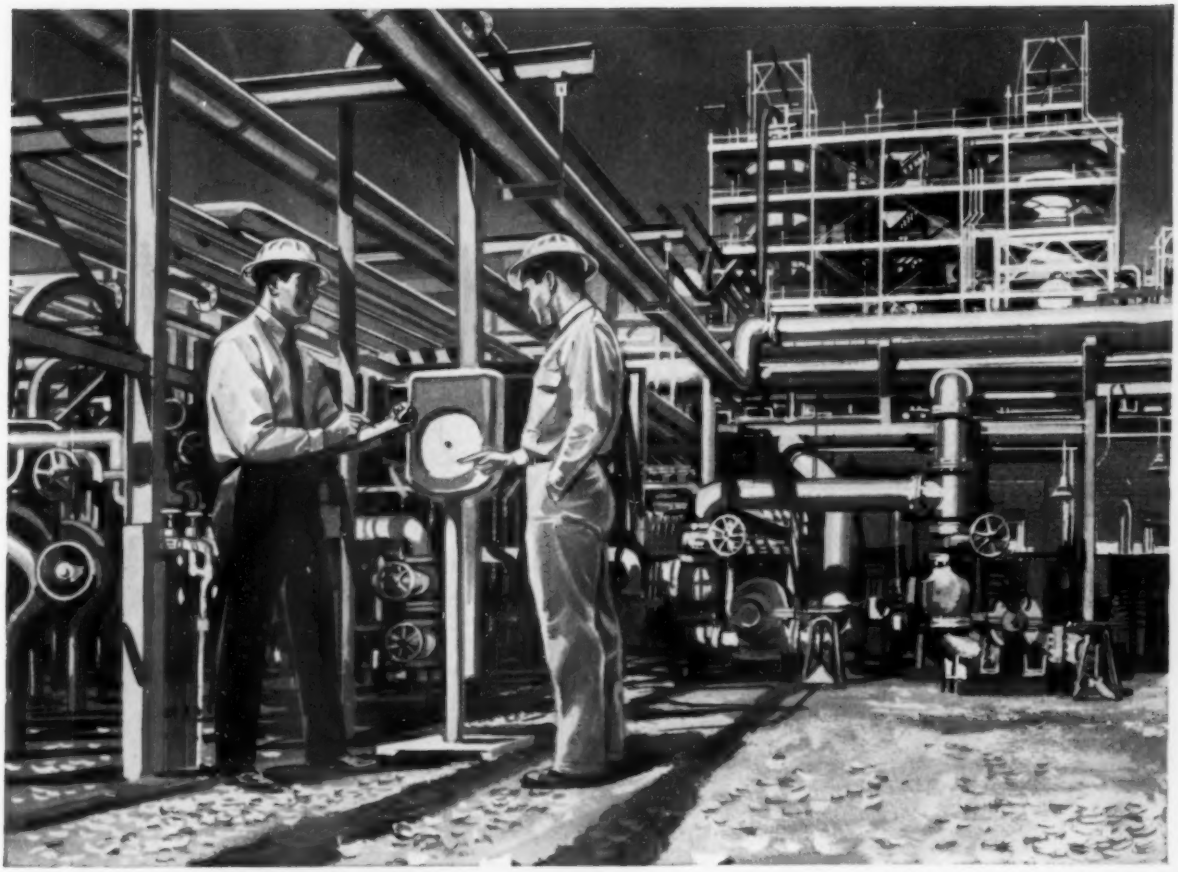

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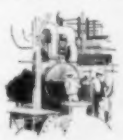

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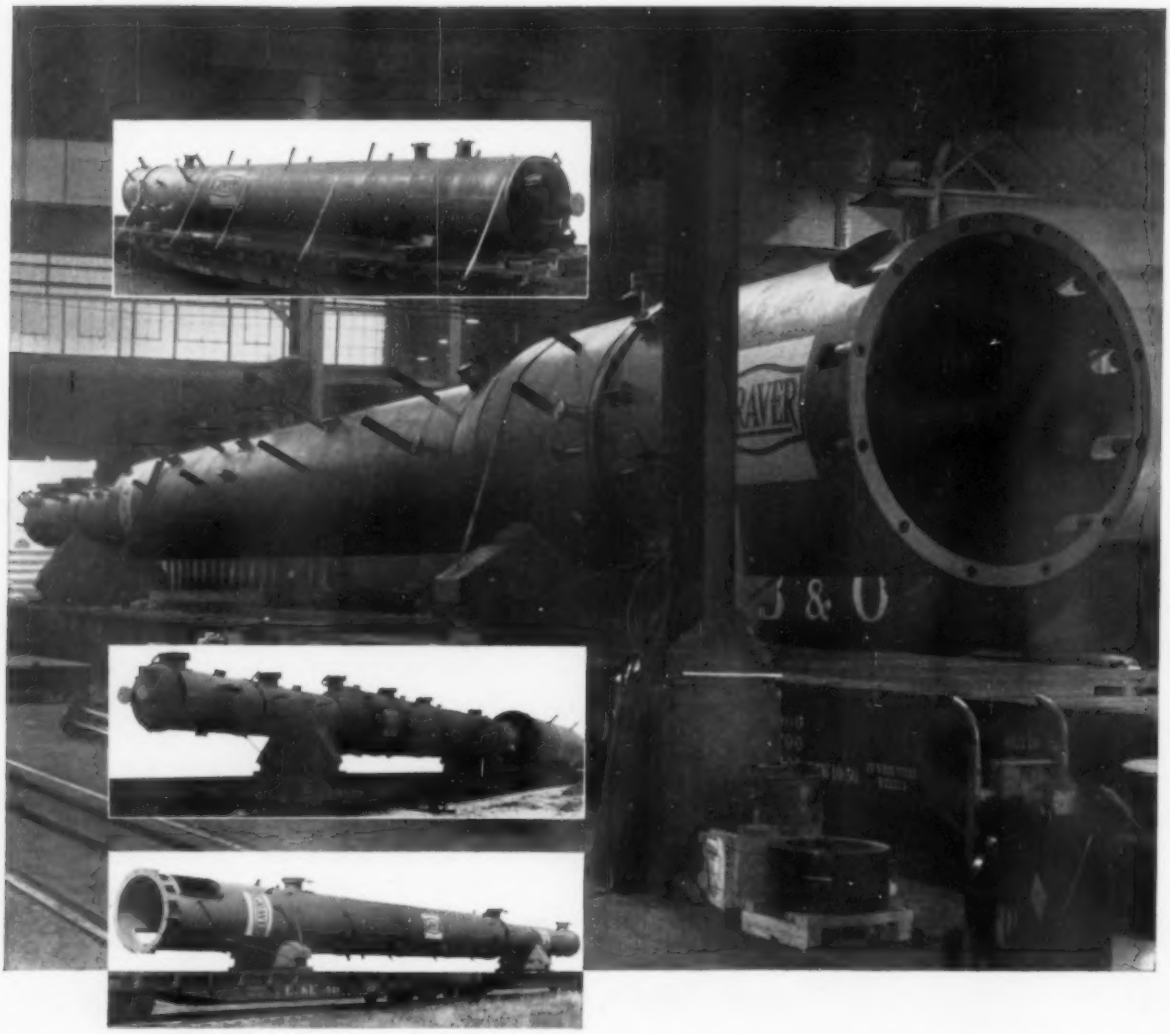

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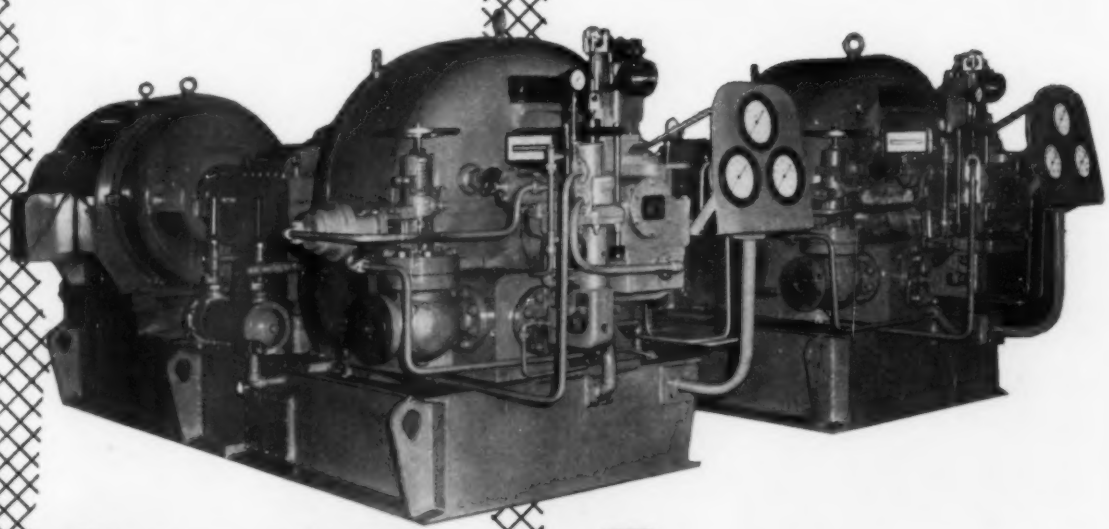

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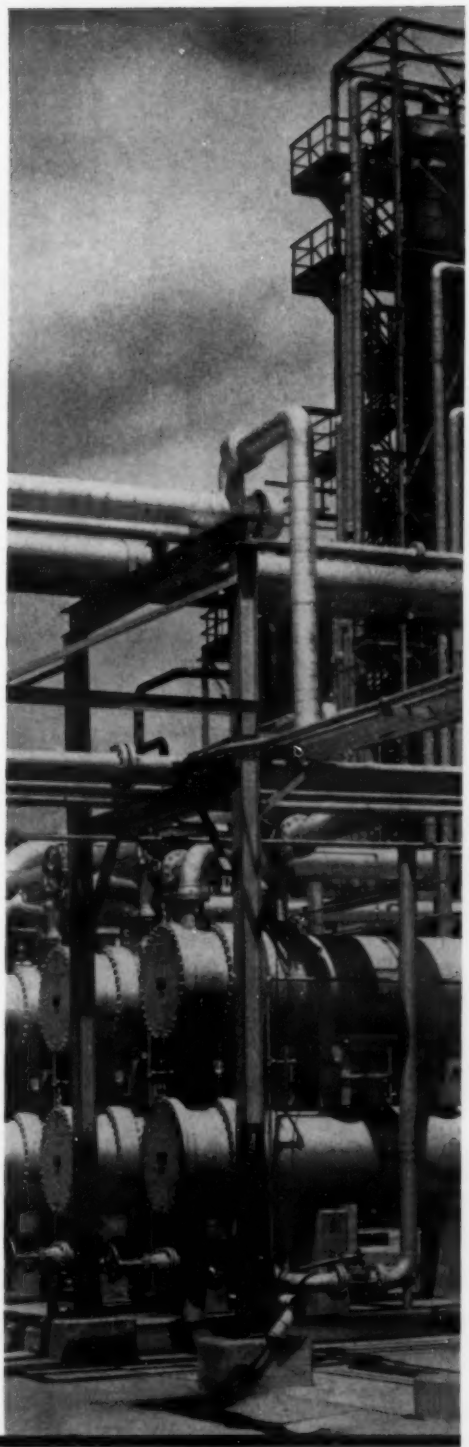

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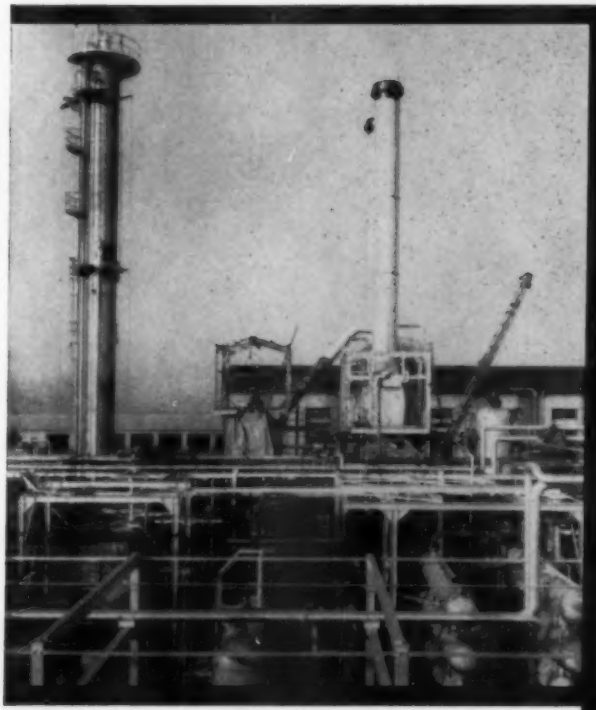
FOOD MACHINERY AND CHEMICAL CORPORATION
Peerless Pump Division
Plants: LOS ANGELES 31, CALIFORNIA and INDIANAPOLIS 8, INDIANA

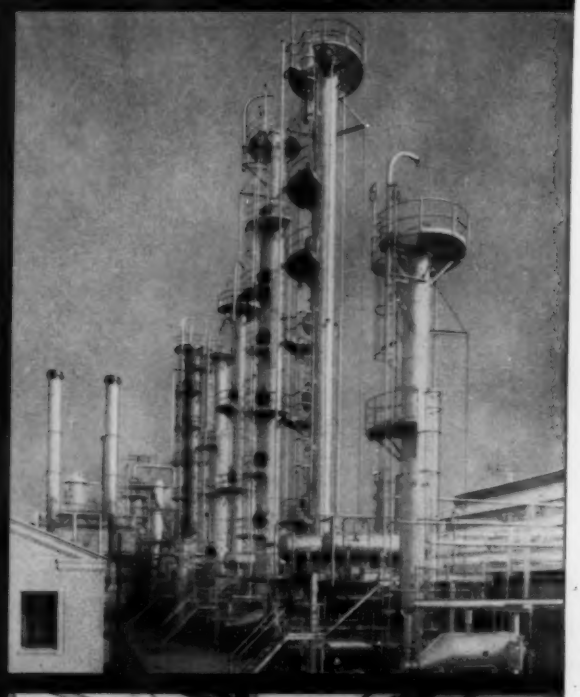
PEERLESS PUMPS

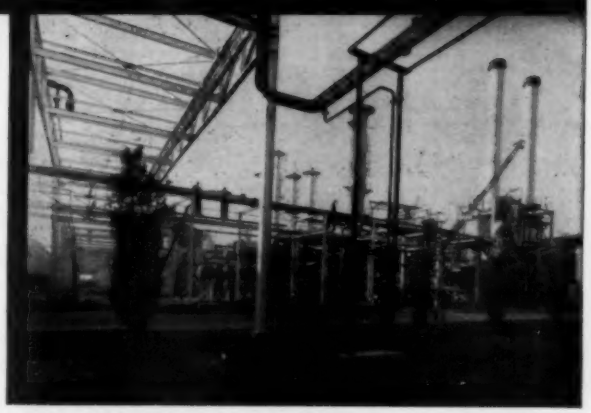
In Germany...

ANOTHER JOB WELL DONE BY PROCON



Heat exchanger in foreground, fractionation tower at left and heater stacks on right during construction.





Top—Fractionation section of the finished Platforming and Unifining units.

Bottom—Nearing completion, heat exchangers, left, in series with the fractionation section and heaters on the right.

Procon construction helps rebuild Deutsche Erdöl A.G. refinery at Heide, Germany

With a well-planned reconstruction program the Heide refinery of Deutsche Erdöl A.G. Hamburg, is rapidly regaining leadership among European petroleum refiners.

Latest advances in the DEA reconstruction are the Platforming® and Unifining* units recently completed by Procon. With these new units DEA can now supply Northern Germany (Schleswig-Holstein) and parts of Denmark with premium grade gasoline. Formerly premium gasolines for this area had to be transported from great distances. Procon construction was completed on time and up to every specification.

For petroleum refinery, petrochemical or chemical plant construction the world over, remember, "For really fine class work, finished against all odds and finished on time . . . call on Procon."

*Trademark

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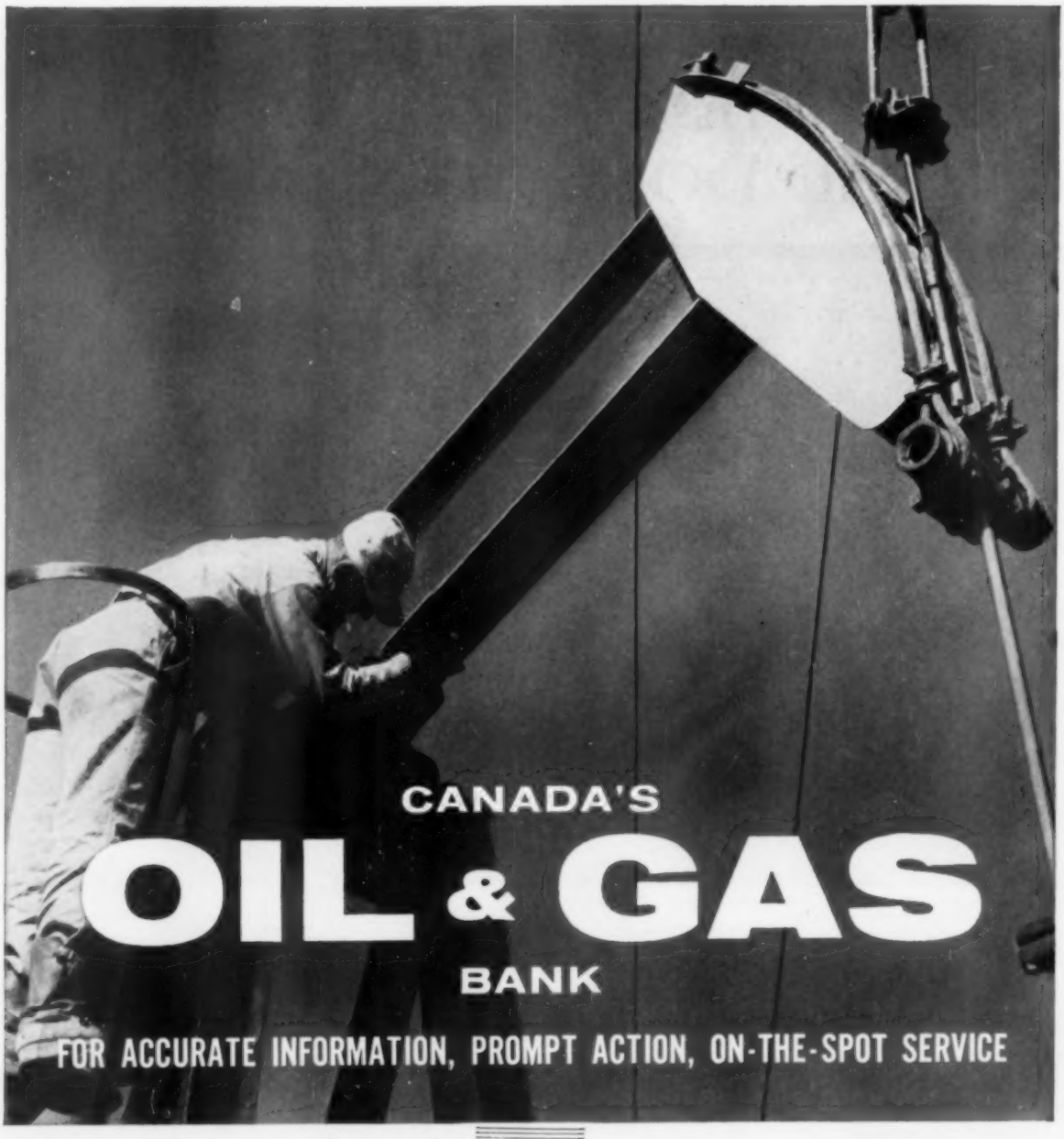
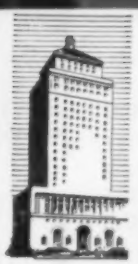


With over 300 branches throughout Canada's Western provinces, the Royal Bank is in a unique position to provide complete, on-the-spot banking service to those entering the oil and gas industry as well as to those already established in it.

In addition, the Royal maintains a special Oil and Gas Department, staffed by experienced "oil bankers," which is exceptionally well organized to supply current information and helpful guidance. This department issues Oil and Gas bulletins containing current information and statistics that are basic to the Canadian industry. For an up-to-date list of bulletins, write The Royal Bank of Canada, Oil and Gas Department, 409 Eighth Ave. W., Calgary, Alta.



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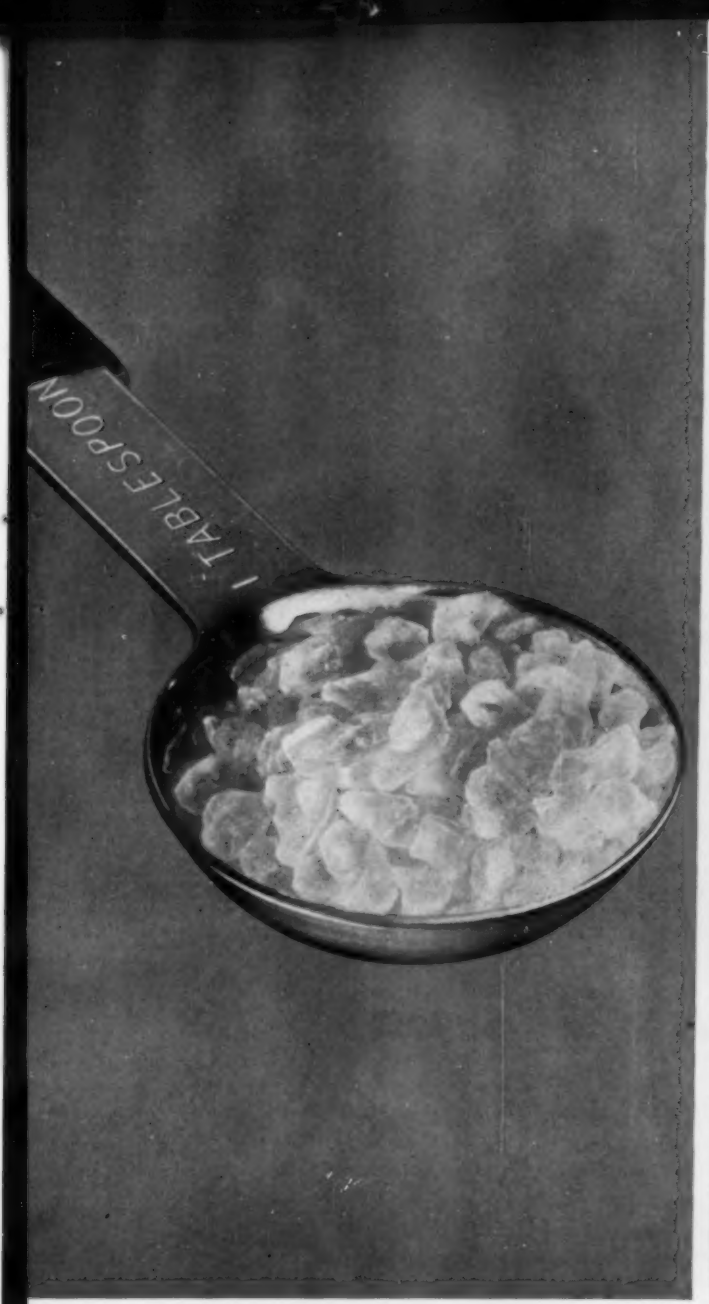

Which has the greater surface area?

Not the football field! One cubic inch of Davison Silica Gel boasts a surface area of about 90,000 square feet . . . much more than a football field. It's a high capacity desiccant!

Davison Silica Gel adsorbs about 45% of its weight of water from saturated air. What makes it so vapor "thirsty"? One, its enormous internal surface. Two, its millions of tiny pores or capillaries. These *attract* vapors, *condense* them, *hold* them as liquids.

That's why you'll find Davison Silica Gel so efficient in drying air and gas. A variety of particle sizes, densities and adsorptive capacities are available. Each has been developed to meet specific application demands. There is one to suit yours.

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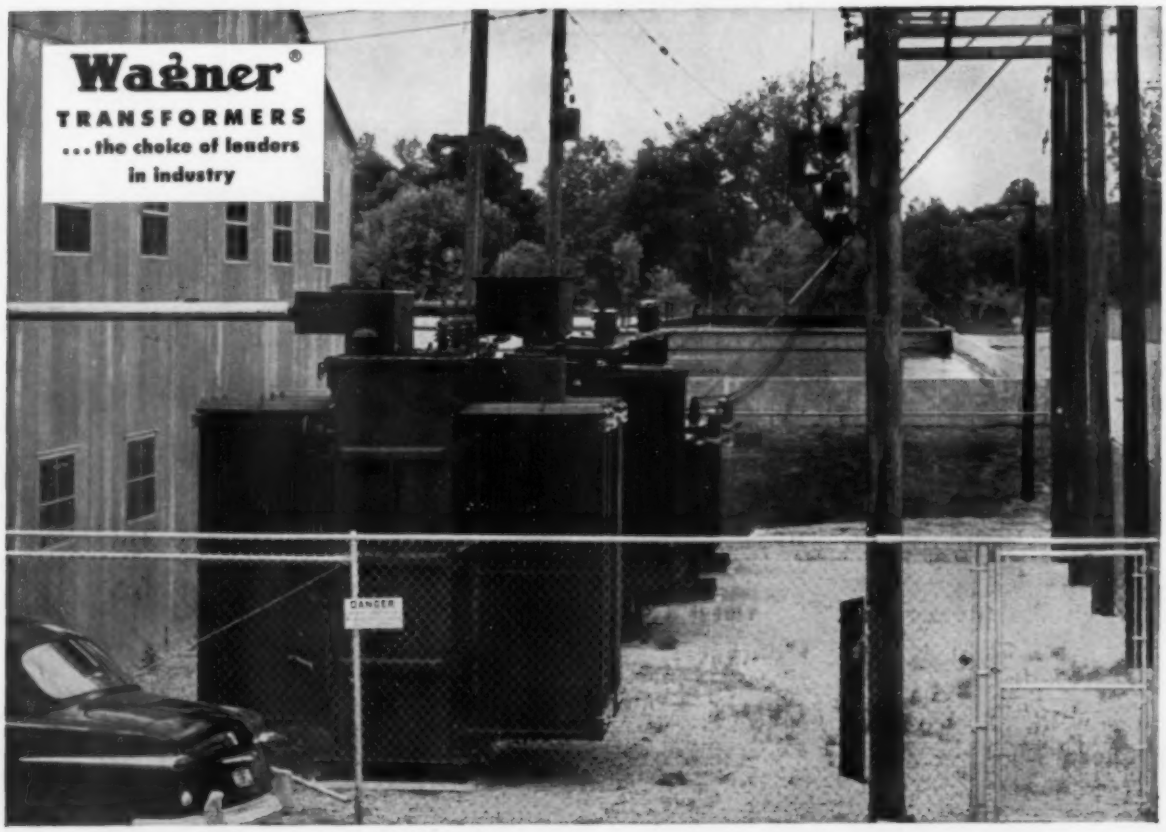

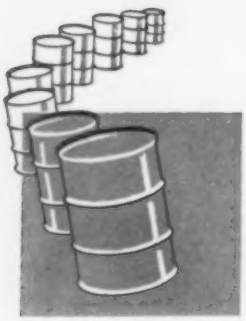

Trading Water for Oil

In Southern Illinois, over twenty oil companies have wells in the 10,000 acre Lake Centralia-Salem oil field. When production in this field dropped off, these companies banded together and decided to water-flood the field by pumping water underground through former oil producing wells to force more oil to move to the remaining wells.

What happened? The amount of oil produced has been greatly increased. Today, one well that formerly produced only 5 barrels of oil a day now yields 650!

Up to 130,000 barrels of water a day are pumped into the oil field, yet with the help of automatic devices and pushbutton control, the entire operation of the field takes only a handful of men. Electric power is at work, much of it supplied through the 2500 kva Wagner transformer, shown in the foreground above, that supplies power for equipment in the injection pump house.

Wherever electric power is used, Wagner transformers efficiently and dependably handle their never-ending job of supplying proper voltages for every purpose.

Let a skilled Wagner engineer discuss your transformer needs with you. Call the nearest of our 32 branch offices or write us direct.

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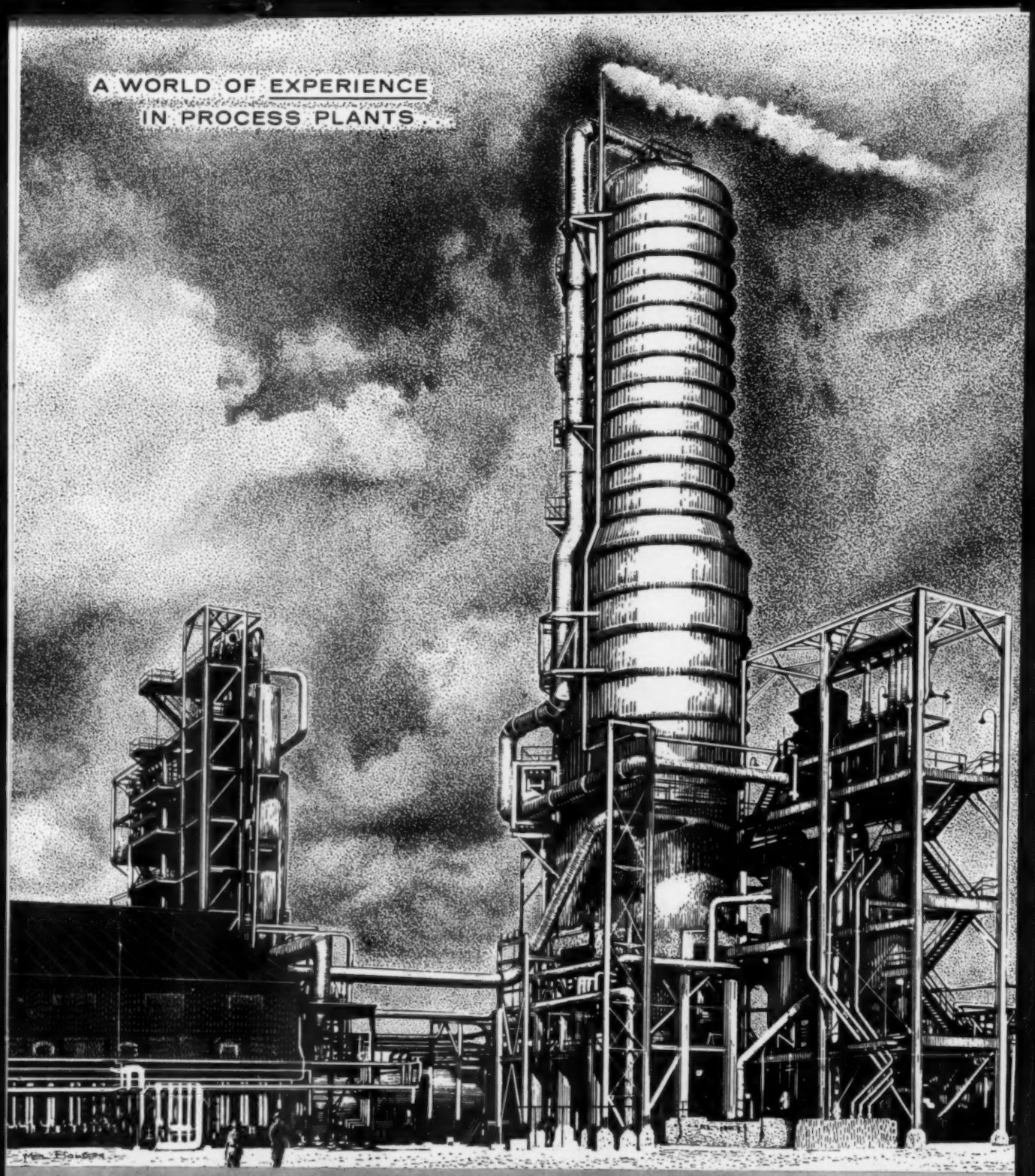

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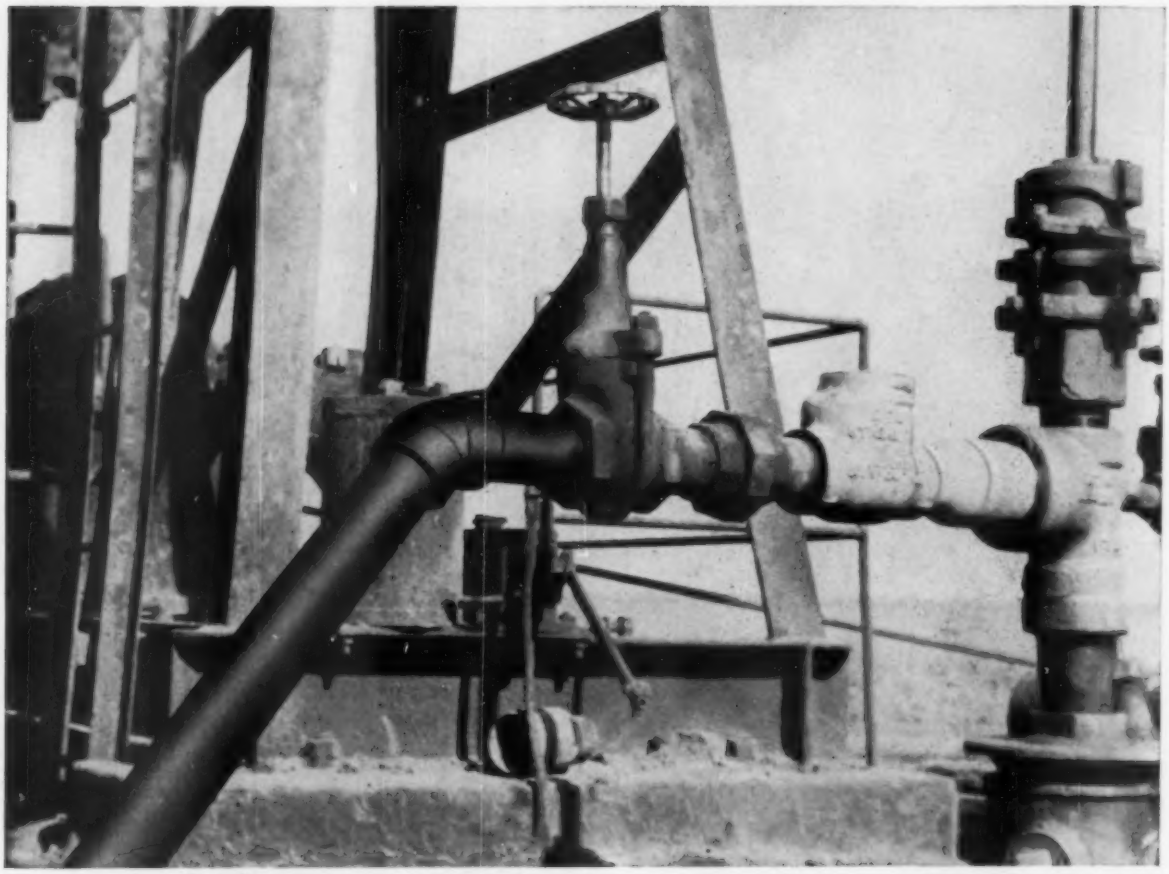
USCOFLOW PLASTIC PIPE



Mr. Usco says:

PIPE IN NEW SAVINGS with UscoFlow!

In these days of constantly rising costs, UscoFlow plastic pipe has become a big hit in the oil fields. Oil men will tell you it slashes plenty of overhead costs because UscoFlow is:

- Immune to galvanic corrosion.
- Highly resistant to both salt water and sour crude oil.
- Low in installation cost.
- Easily installed with solvent-welded fittings.
- Virtually maintenance-free.

That's why UscoFlow Pipe eliminates the severe corrosive problems found in handling salt water and sour crude. *It brings savings in piping replacement and maintenance that will continue for an indefinite time.*

New, black UscoFlow Pipe has great impact strength and handles high pressures, yet is semi-flexible and light in weight. A complete line of pipe and fittings is available through supply stores in all oil fields.

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Lubrotite Gate Valves form a part of the complete R-P&C line, which includes gate, globe, angle and check valves in all standard materials; all in a wide range of sizes, styles and pressure classes. Order through nearby R-P&C Distributor. Write our Reading office for catalog.

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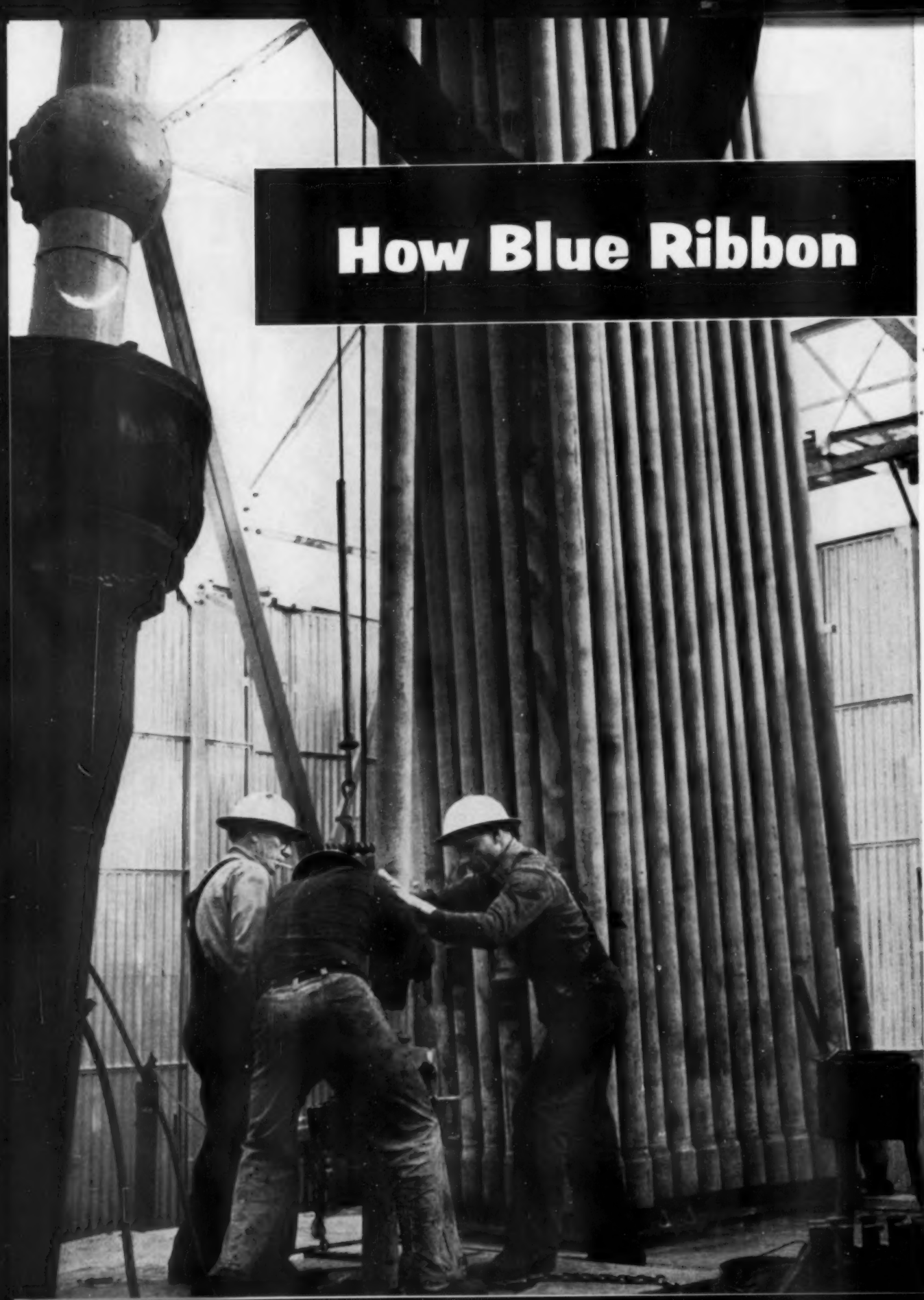
How Blue Ribbon

sets Drilling Records

When made of **Blue Ribbon** heat-treated alloy steel, or **Blue Ribbon Vanadium, J&L Drill Pipe** digs the world's deepest wells. Records for greater economy and over-all efficiency are established every day by **J&L Drill Pipe.**

There are built-in reasons — indestructible reasons — for the better performance of **Blue Ribbon.** These reasons begin at the iron ore mine and multiply through every guarded, tested step in mill and finishing processes. They are integral with the steel itself — and J&L is a great name in steel.

J&L Supply service, alert and capable, completes a drill pipe package contractors like. It assures improved performance from a major investment.

J&L Drill Pipe is made in sizes and grades to meet the requirements of careful management in planning wells to any depth. It is upset for grip type, counterbore weld and flashweld tool joints.

For pertinent technical data, contact any J&L Supply man or write us at Tulsa — Drawer 2481.

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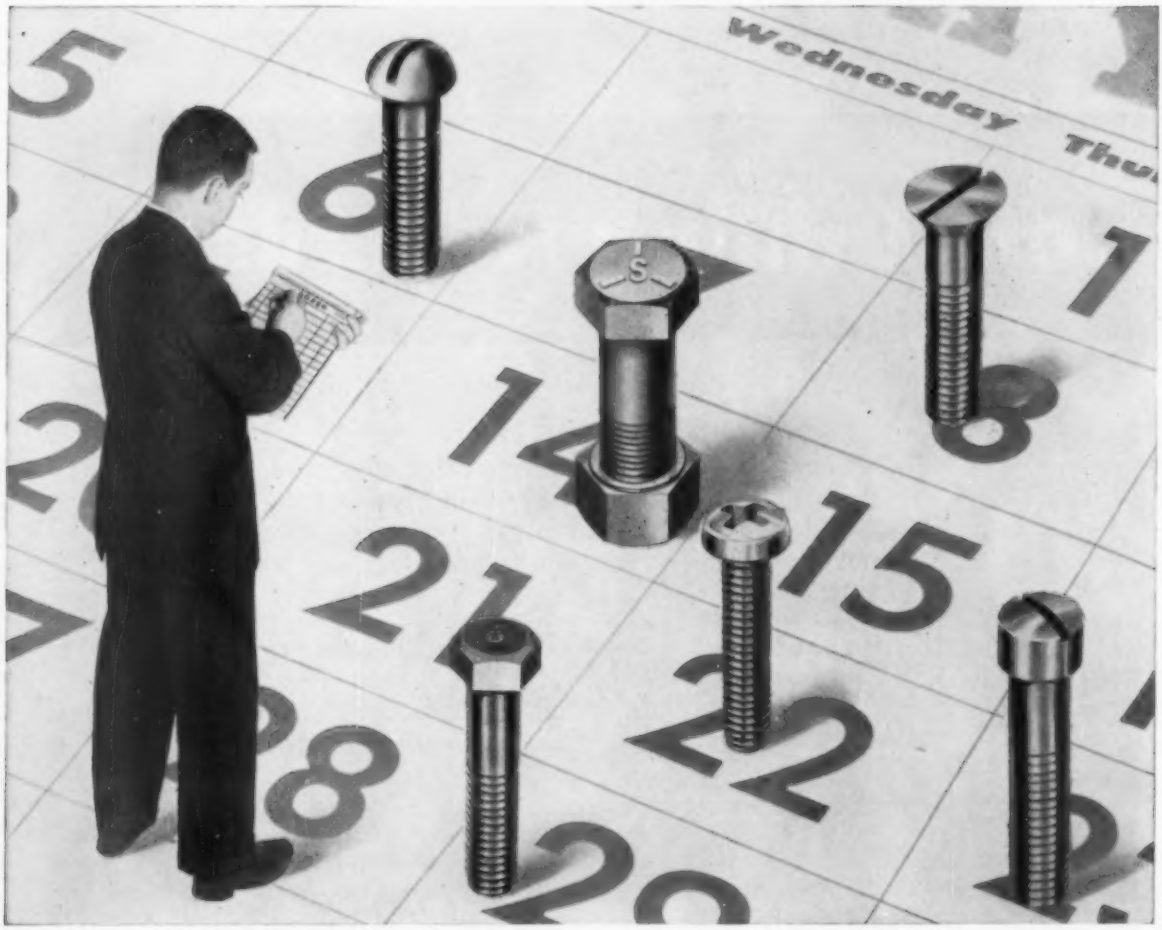
If it's sold by J&L....
It's the best available



Why Your Sheffield Man: Can deliver the right bolts at the right time

The Sheffield line is the FULL line of bolts. That's one reason why your experienced Sheffield Man can save you time and assure you the *right* bolt every time. Other reasons: Sheffield's bolt plant is one of the country's largest, and is located to give you quick, dependable service.

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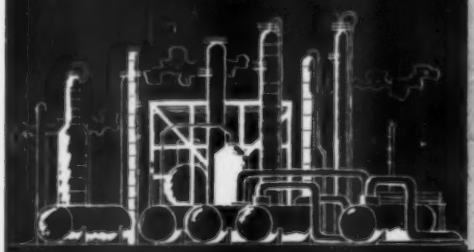
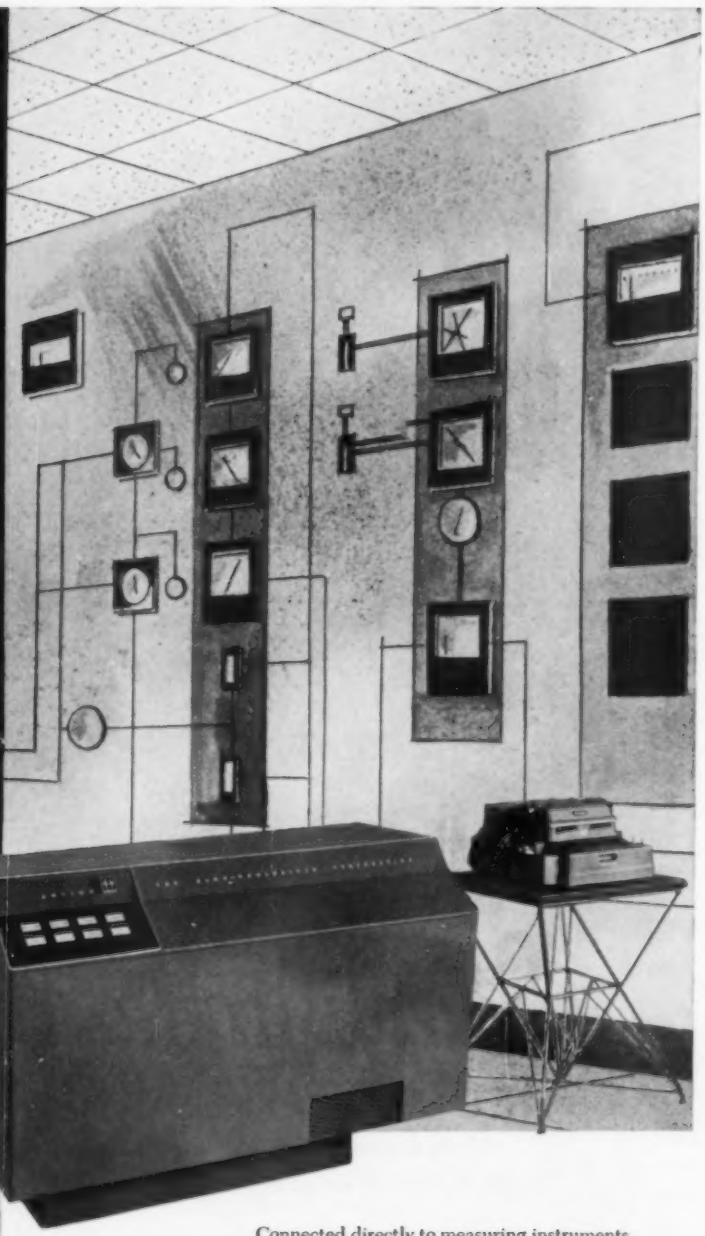
advanced data logging



...with the RW-300 digital control computer

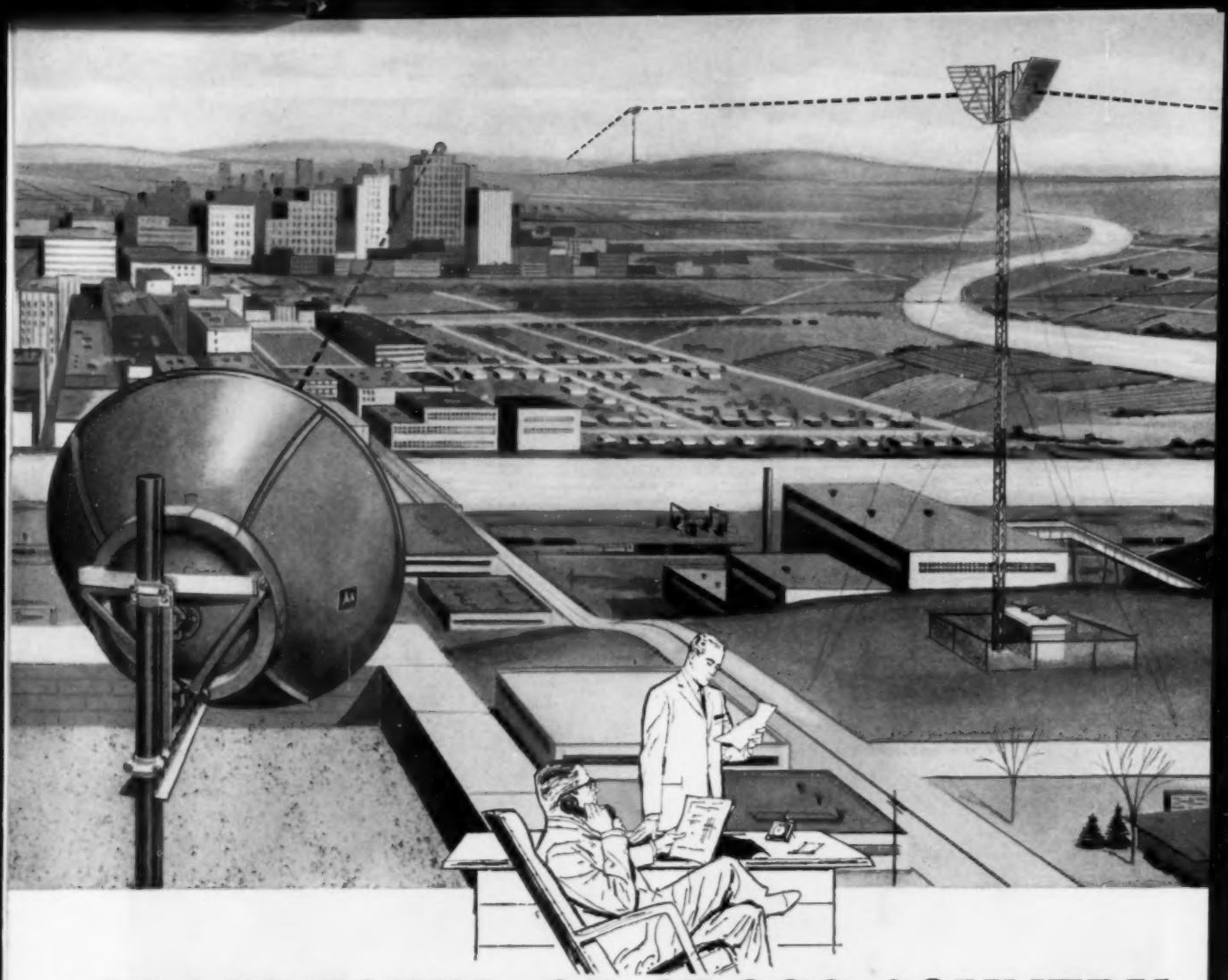


The Ramo-Wooldridge RW-300 Digital Control Computer—the first digital computer designed specifically for automatic on-line process control and data logging—offers significant advantages as the heart of advanced data logging and scanning systems for oil refining, chemical, and other process industries. Unlike conventional data loggers, the RW-300 can be converted to completely automatic control through a minor field modification without purchasing expensive additional equipment and without scrapping any part of the existing logger.

Connected directly to measuring instruments, the RW-300 can do more than log raw or partially processed data. It can also compute and immediately print out more meaningful information such as yields, conversion efficiencies, and energy balances. The RW-300 can also calculate operating guides for plant personnel to follow. In addition to checking process variables against upper and lower limits, the RW-300 can perform more sophisticated checks on process equipment and the process itself. These checks reduce plant maintenance costs by detecting faulty operation of the process in time for corrective action.

For technical information on automatic process control and advanced data logging with the RW-300, write: Director of Marketing, The Thompson-Ramo-Wooldridge Products Company, P. O. Box 45067, Airport Station, Los Angeles 45, California, or call OSborne 5-4601.

THE THOMPSON-RAMO-WOOLDRIDGE PRODUCTS COMPANY



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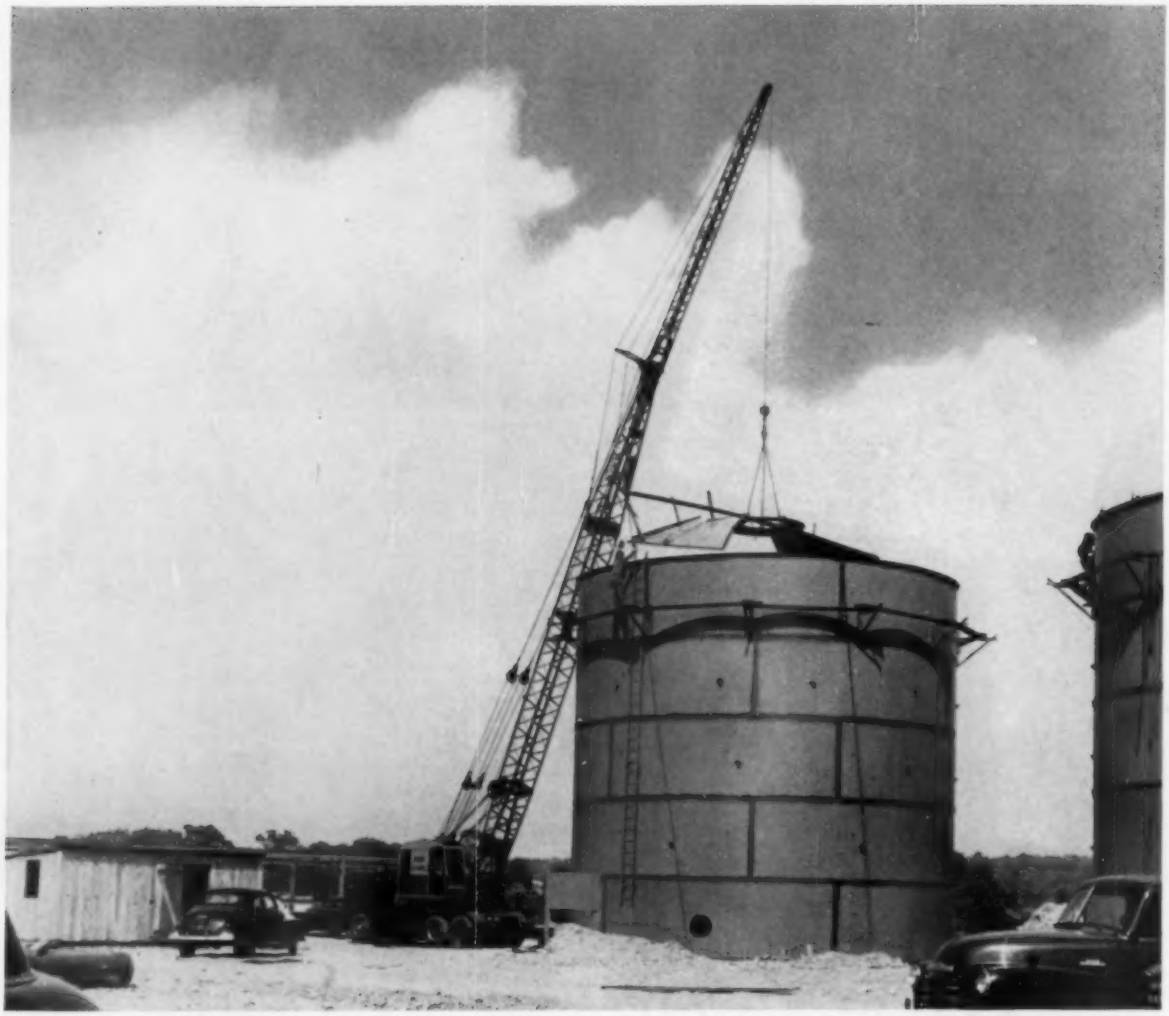

REACH HIGH AND WIDE
with a cost-cutting Transit Crane

Whether you're handling routine plant maintenance work at the refinery, or new construction, you'll get *extra* money-saving features with these Bucyrus-Erie Transit Cranes!

Bucyrus-Eries give you high-speed mobility that saves time between jobs, maneuverability for close-quarter operations. You get long-boom stability that lets you reach over existing machinery and framing to spot in new assemblies. The independent power-controlled lowering boom hoist (optional on 11-B), coupled with big, heavy-duty hoist clutches and brakes, give you positive, accurate load control.

Bucyrus-Erie Transit Cranes are available in a full range of sizes, too. The newest member of the Transit Crane family is the 10-ton 11-B, a low-cost handyman for dozens of assignments in the refinery or in the field. Also available are 15-ton 15-B, 25-ton 22-B, and 35-ton 30-B Transit Cranes, all mounted on fast-moving crane carriers built to Bucyrus-Erie specifications!

Let us give you all the details on these low-cost money-savers today! See or call your nearby Bucyrus-Erie distributor for further information.

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This 60' x 100' Rigid Frame pipeline supply warehouse has 16' x 18' overhead door for entry of largest trucks.

WANT A BUILDING WITH NO WASTE SPACE?

The Rigid Frame is it! Made by Stran-Steel,* this modern steel building is free of columns, low in cost and custom-tailored to your specifications.

USES: Clear-span, wall-to-wall oil field warehousing and storage, rugged service or laboratory facilities, field offices or pipeline stations.

MATERIALS: All-steel construction. Attractive *Stran-Satin* wall and roof-panels blend well with other building materials.

SIZES: Choice of six widths from 32′ to 80′ and multiples. Lengths in 20′ multiples.

FEATURES: Column-free interiors for efficient materials handling and plant layout. Speedy erection. Low maintenance. Fire safety.

COST: Low, because Stran-Steel structures are mass-produced. Easily financed through dealer with 25% down, 5 years to pay.

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*The complete line of Stran-Steel buildings also includes the low-priced Stran-Master all-steel pole-type building.

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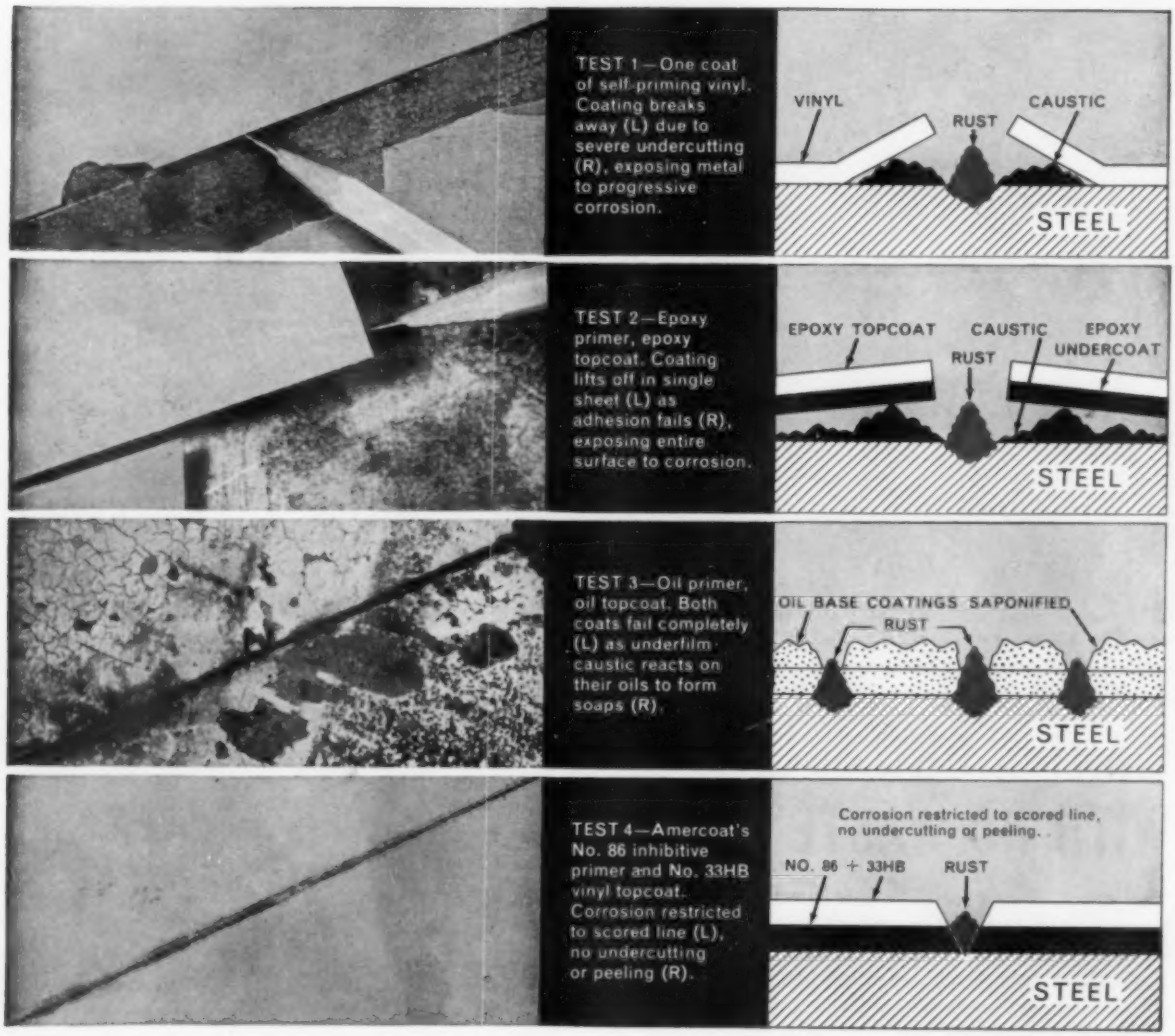
PUZZLED ABOUT PRIMERS?

Here are tests you can duplicate


TEST 1—One coat of self-priming vinyl. Coating breaks away (L) due to severe undercutting (R), exposing metal to progressive corrosion.
VINYL
RUST
CAUSTIC
STEEL
TEST 2—Epoxy primer, epoxy topcoat. Coating lifts off in single sheet (L) as adhesion fails (R), exposing entire surface to corrosion.
EPOXY TOPCOAT
CAUSTIC
RUST
EPOXY UNDERCOAT
STEEL
TEST 3—Oil primer, oil topcoat. Both coats fail completely (L) as underfilm caustic reacts on their oils to form soaps (R).
OIL BASE COATINGS SAPONIFIED
RUST
STEEL
TEST 4—Amercoat's No. 86 inhibitive primer and No. 33HB vinyl topcoat. Corrosion restricted to scored line (L), no undercutting or peeling (R).
Corrosion restricted to scored line, no undercutting or peeling.
NO. 86 + 33HB
RUST
STEEL

The purpose of these accelerated tests is to show what happens when various types of coatings are exposed to a typical corrosive environment. Four clean steel panels, free from mill scale and rust, were coated with different combinations of primers and topcoats. Each was scribed to bare metal and immersed in salt water in the presence of free oxygen, for two weeks.

As caustic deposits formed over cathodic areas of the steel in tests 1, 2 and 3, failure occurred in three ways. The vinyl, though not directly attacked, was undercut as caustic spread beneath the film and destroyed adhesion. The epoxy coating, known for critical adhesion to smooth metal, proved impervious to caustic attack. It was, however, lifted in its entirety as moisture spread beneath the surface. The entire oil paint film was quickly penetrated by the salt solution, creating widespread corrosion and caustic formation. The caustic then reacted with the oil to saponify the film.

In the fourth test the corrosion was limited to the score mark. Reason: Amercoat No. 86 Primer resists undercutting and adheres tenaciously, inhibiting electrolytic corrosive action.

The conclusions are clear. To provide long term protection in corrosive service, start with Amercoat No. 86 Primer, which provides a sound and lasting base for quality topcoats such as Amercoat No. 33HB.

Write today for complete data on Amercoat No. 86, and have the details on hand when planning your next important coating job.

Amercoat® CORPORATION

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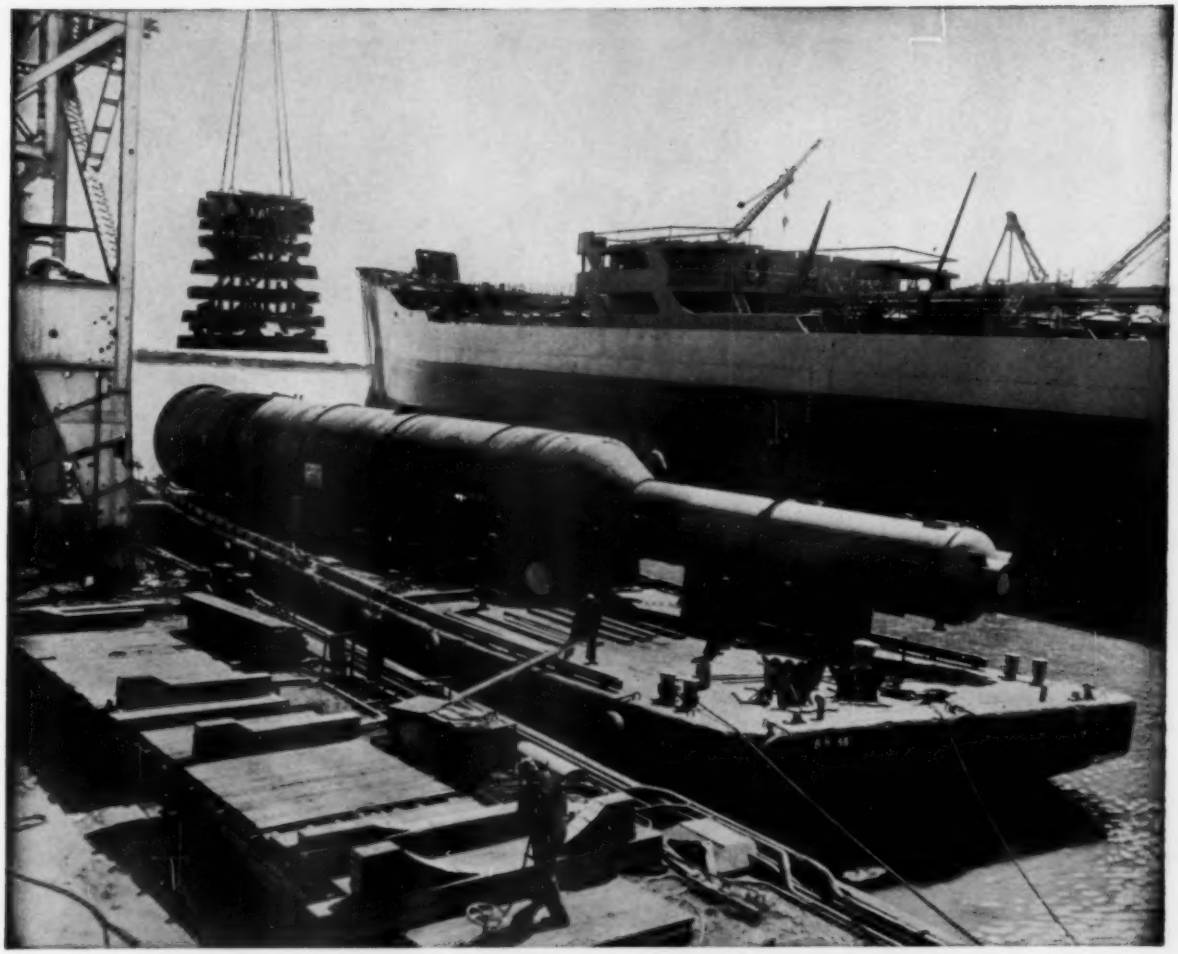

standard procedure: VERSATILITY...

The variety of work which Sun Ship's integrated shops produce for use by industries on land and sea brings a matching variety of shipping problems.

Our facilities for tidewater shipment are used to economical advantage on many of the massive structures that go into the making of the nation's petroleum and chemical industries. The barge shipment of tower and shed row baffles, shown above, is a good example.

And of course—when shipment by land is necessary—Sun Ship rigging and routing find the ways and means to handle such items as large-diameter columns by rail and truck.

It's all a part of the versatility which forty years' experience has made part of "standard procedure" in service of its customers.

Our Sales Engineering Department would be glad to use its experience in helping you overcome any problem of construction or shipment that faces you. Write

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SHIPBUILDING & DRY DOCK COMPANY

ON THE DELAWARE SINCE 1916 CHESTER, PA.

THIS MAN'S A SPECIALIST IN PROTECTING YOUR PROFITS. His title is Dowell Service Engineer. His job—to study your maintenance cleaning problems, recommend the proper solutions and apply chemical solvents to help you make more profit. He represents a team of specialists who have rendered old-fashioned all other methods of cleaning product, process and steam generating equipment. His method is Dowell Service, the modern way—using solvents—to remove scale and sludge from all kinds of metal equipment, tanks, piping and lines.

Specifically: one processor had been performing his own turnaround service—using mechanical methods—at an annual cost of $315,000. The Dowell Service Engineer and his team performed the same service in 1/10 of the time at a cost of $2300. The savings in downtime alone amounted to $210,000.

If your maintenance and operating engineers do not know the profit possibilities with Dowell Service, ask them to get the facts for you. For specific information on how chemical cleaning can help your plant to greater profits, call the Dowell office nearest you. DOWELL INCORPORATED —A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY. Headquarters and research center, Tulsa, Oklahoma, with 165 offices and stations to serve you.

chemical cleaning services for industry DOWELL

This week's SHOWCASE features . . .

Alloy for high temperatures

. . . to 1,800° F. comes in sheet and wrought forms. Called Rene 41, it's produced under vacuum-melting conditions. In sheet stock, it comes rolled or polished in sizes to 48 by 120 in. in thicknesses down to 0.010 in. Wire, including weld wire and wrought bar stock, is also available.

The maker claims it is the strongest alloy in sheet form ever produced in large quantities for use at elevated temperatures. And it possesses excellent formability characteristics and is readily machinable. Drawing, bending, spinning, and other conventional shaping methods can be used. Ultimate tensile strength is 180,000 psi. at 1,000° F. and 40,000 psi. at 1,800° F. Yield strength is 135,000 psi. at 1,000° F. and 35,000 psi. at 1,800° F. **Write or call: Cannon - Muskegon Corp., 2875 Lincoln Street, Muskegon, Mich., for details on Rene 41 alloy.**

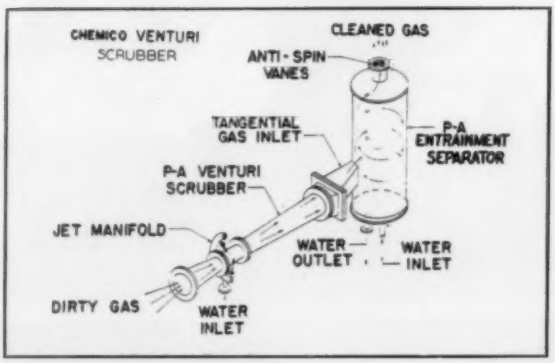
●

Indicating flowmeter

. . . for 2,000 psi. comes with aluminum or brass body.

Special flowmeter body materials for corrosive applications are available too. Meter scale ranges run from 0-to-6 to 0-to-6,000 g.p.h. For scale ranges up to 20 g.p.m., the meter is available for direct installation in the flow line. For larger scale ranges, a shunt arrangement is used.

The meter is furnished complete and ready to connect into the flow piping. Hermetically sealed, it can be installed in a vertical or horizontal position. The maker reports it is unaffected by vibration. A small, constant pressure drop across the meter provides power for operation. **Write or call: Seico Instrument Div., Eclipse Fuel Engineering Co., Rockford, Ill., for details on indicating flowmeters.**



Gas scrubber for refineries

. . . in air-pollution control and chemicals recovery comes in two types to handle both micron and submicron-sized particles. The scrubber is said to match or surpass the efficiency of precipitator systems.

In the scrubber for submicron particles, coalescence of mist or agglomeration of dust results from the atomization of a water curtain introduced at the throat of a venturi. Particles are then separated mechanically from the gas stream by cyclonic action.

Where only micron-sized particles are to be removed, sprays in an axially mounted manifold in the scrubber give scrubbing action.

The scrubber has no moving parts to maintain. The water can be recirculated. Pollutants are recovered for controlled disposal or reuse. No stream pollution results, the maker reports.

Fabricated in a variety of materials, the scrubber can be applied to virtually any corrosive or abrasive condition and operated at temperatures to 1,800° F. without difficulty. **Write or call: Chemical Construction Corp., Commerce Building, Houston 2, for Bulletin M-102.**

Send this **Showcase Coupon**

to the Manufacturer of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

.....

Described in OIL AND GAS JOURNAL - Issue of May 19, 1958

NAME.....TITLE.....

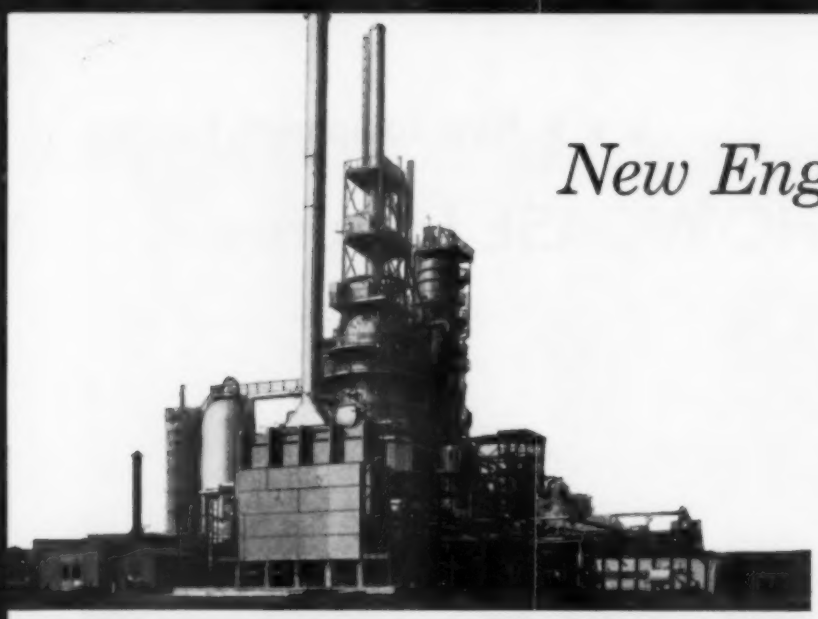
COMPANY.....

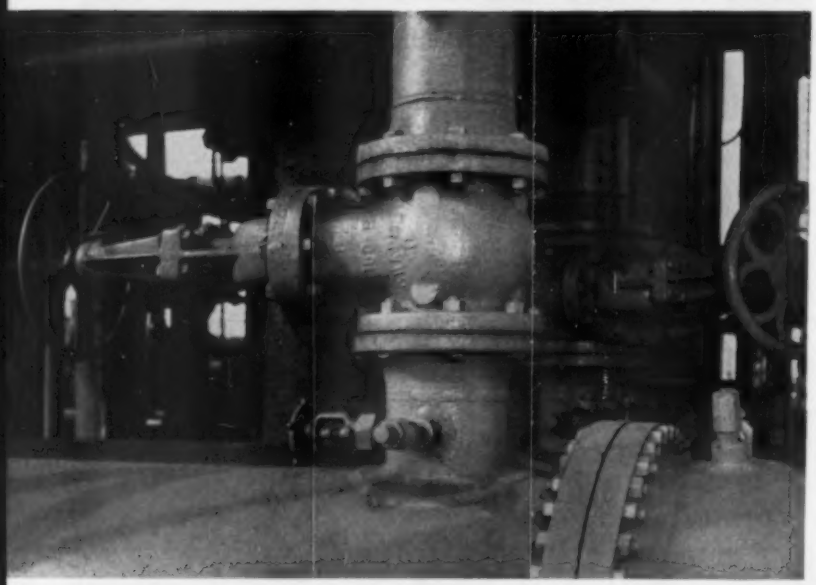
ADDRESS.....

CITY.....STATE.....

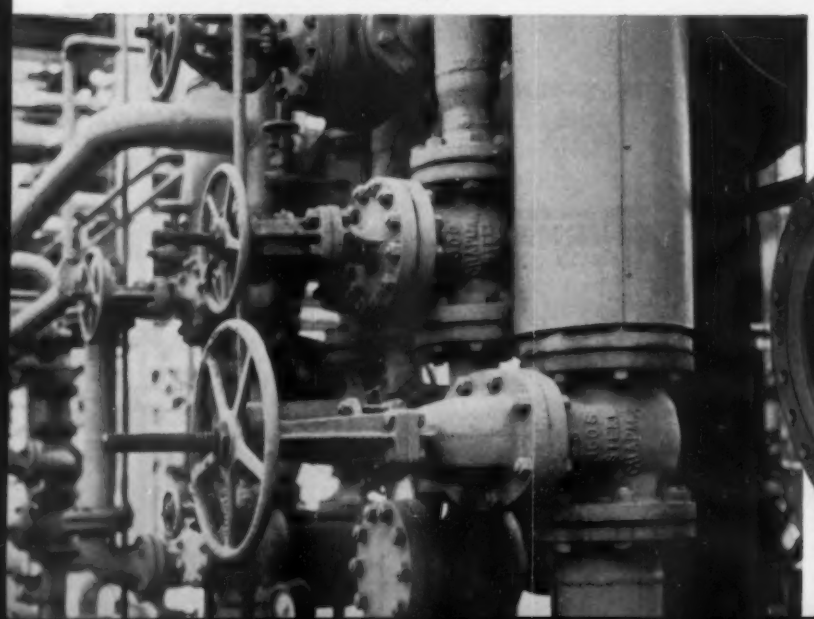
DATE.....

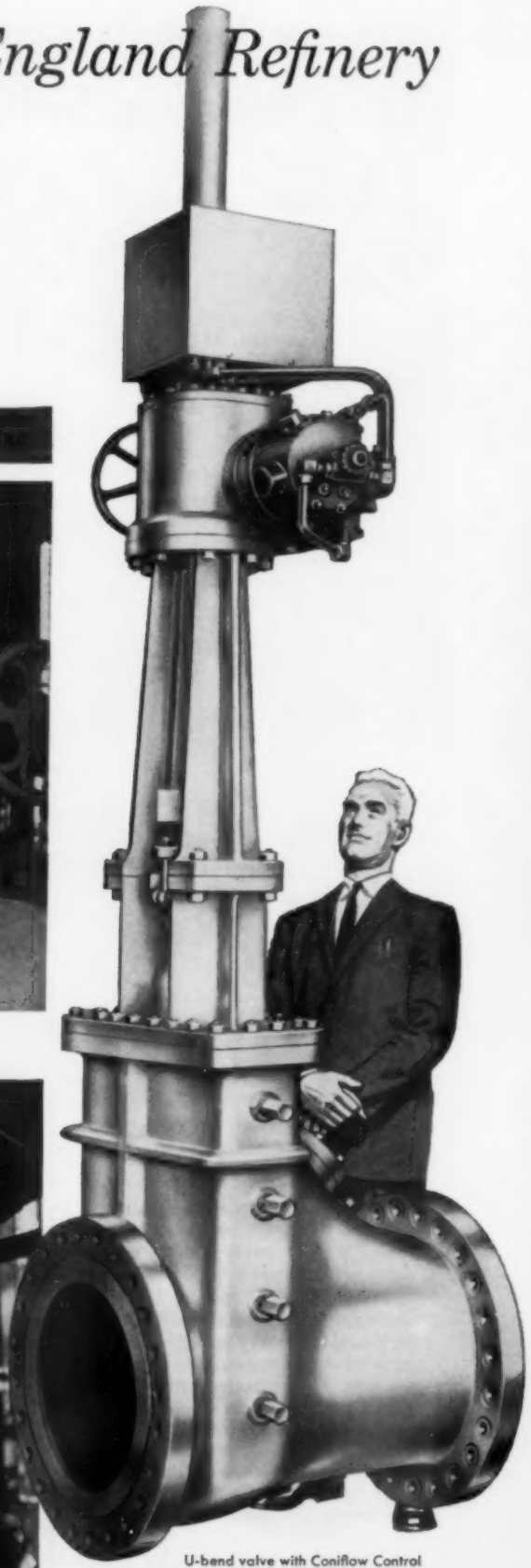
New England Refinery





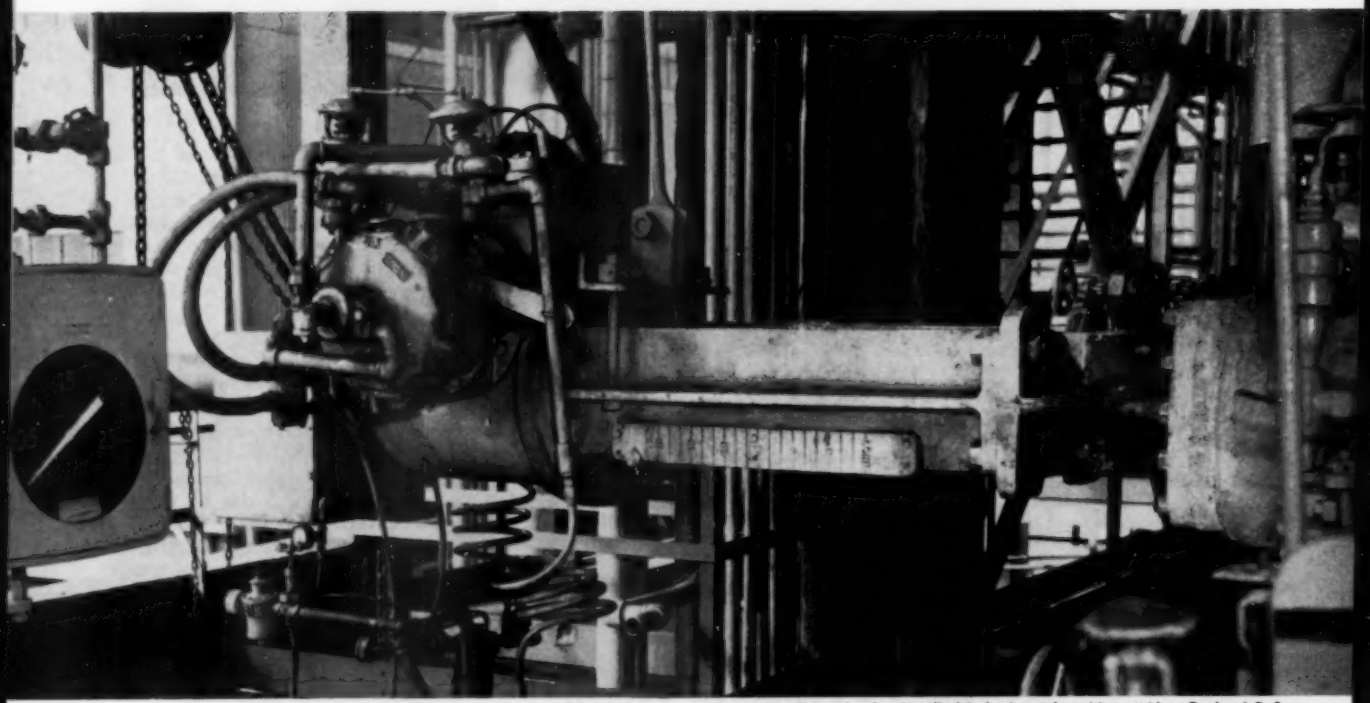
Above and below, some of many Chapman Valves giving service at New England Refinery at Everett.





U-bend valve with Coniflow Control designed and built by Chapman for catalytic cracking service.

uses **CHAPMAN VALVES**



U-bend valve installed in horizontal position at New England Refinery.

This isn't just a regional story. Far from it. In addition to the New England Refinery in Everett, Massachusetts, the Esso Standard Oil Company has other refineries at Linden, New Jersey; Bayonne, New Jersey; Baltimore, Maryland; Baton Rouge, Louisiana and Charleston, South Carolina.

These, like other leading refineries in all parts of the world, use Chapman Valves . . . both standard and special . . . *for good reasons.*

Chapman has all the engineering and manufacturing facilities to think out and work out valves that will fully meet the requirements of today and, just as important, to meet tomorrow's requirements.

Esso's New England Refinery is a good example of meeting these requirements. When World War II brought on an urgent demand for better and cheaper gasoline and fuel, a new method . . . catalytic cracking . . . was developed. Today, with this added miraculous giant known as a "cat cracker," built by Foster Wheeler, the New England Refinery is a still more modern plant. Tanks with a total capacity of 60,000,000 gallons can be filled with finished products. Some of this production is delivered to all of New England and to parts of New York State to meet industrial, automotive and domestic needs . . . a real, important service.

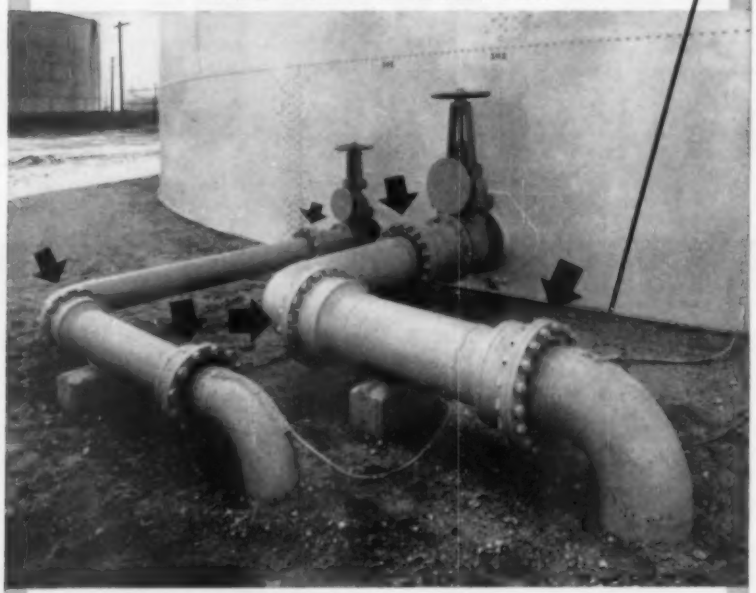
The **CHAPMAN** *Valve Manufacturing Co.*

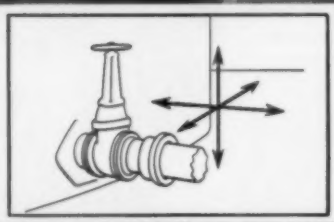
INDIAN ORCHARD, MASSACHUSETTS

It pays to talk about your valve requirements for today and tomorrow with Chapman. The Chapman Valve Manufacturing Company has the men, the brains and the facilities to meet these requirements fully, no matter how tough they are. Chapman has the engineers, metallurgists, experience, and manufacturing capacity to produce the valves you need. Write, and we'll gladly consult with you.

Unlimited Flexibility!

—PROVEN IN SERVICE





Allows 6-Way Movement!

Freedom of movement in any direction is readily possible with these *ball joint connections* of 12" pipe (right) and 8" pipe (left) to 80,203 bbl. tank shown in above photo. (Photo: SHELL OIL COMPANY, Dominguez Refinery, Wilmington, Calif.)

Barco Ball Joints—

provide complete protection against

FIRE, EARTH SHOCK, TANK SETTLING

The rapidly increasing use of Barco's new large size Flexible Ball Joints in California, and other locations, is significant for several key reasons:

1. **Fire-Safe. The joints have passed rigid fire and water spray tests.**
2. **Unlimited flexibility and movement.**
3. **Long service life without maintenance.**
4. **Joints insulate against electrolysis as well as provide movement in all planes.**

Such installations protect piping, valves, and tanks from earth movements, shifts, shocks, and earthquakes. They allow for *tank settling* or *tilting* as well as for *thermal expansion* or *contraction of piping* leading to tanks without creating strain. In case of fire, the joints are "fire safe."

For detailed information, WRITE FOR CATALOG 215B. Joints available in steel with flanged or welding ends. 15° angular flex.

PRODUCTS BACKED BY EXPERIENCE
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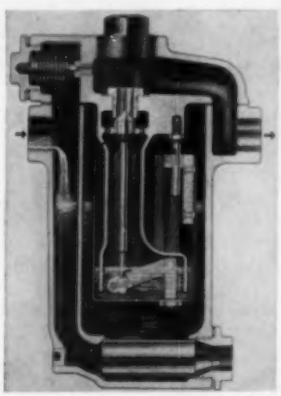
The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Rotary Joints
In Canada: The Holden Co., Ltd., Montreal

Thread cleaning device

. . . uses double wire brush to get tool-joint threads clean. The new Expand-O quick-action thread-cleaning device was developed for drill-pipe tool joints, drill collars, tubing, casing, and well-service joints. The double wire brush provides a reversing, rotating action to clean the shoulder and both sides of threads.

The tool may be used with an ordinary hand brace or with a reversible air or electric drill. The tool expands into the threads under light pressure and operates smoothly on a ball-bearing base. Brushes are easily replaced when worn. **Write or call: Red Label, Inc., Box 1640, Pampa, Tex., for details on thread-cleaning tool.**

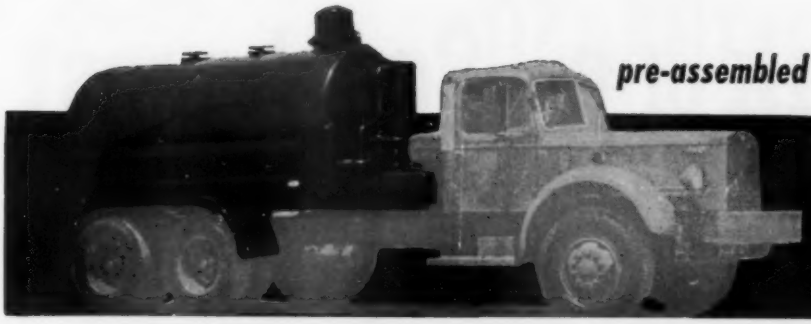
●



Steam trap has thermostat

. . . built-in which is pressure and temperature-compensated with action that follows a steam-temperature curve from vacuum to 150 psig. The bypass thermostat is a liquid-filled, monel-bellows type. It starts opening at 10° below saturation temperature and is fully open at 25° below.

Designated 500-C series, the trap provides fast warmup and efficient handling of entrainment in every stage



pre-assembled VACUUM TANK

Ready to Mount on Your Truck

SELF-CONTAINED MODEL WT is made with capacities of 35, 40, 45, 50 and 55 bbls. Comes complete, ready for work. Has its own gasoline engine, pump and 4-way valve.

THOMPSON, the originators of the unitized vacuum tank, now makes available this self-contained model WT. It's factory-readied for you to mount on any CA 120" truck in your own shops. Put the WT on your truck in the morning; put it to work after lunch!

WRITE FOR SPECIFICATIONS, complete with blue-printed mounting instructions. If you'd like to see a Thompson Unitized Vacuum Tank at work, we'll tell you where, in your own area, you can watch it save time and money — pay for itself time and time again. Write today.

FOR SUPER-FAST CLEANING OF:

- CRUDE TANKS
- DRAIN BOXES
- RUN-DOWN TANKS
- SEPARATOR BOXES
- CAUSTIC TANKS
- DRAIN LINES
- CATALYST SLURRY
- And a hundred other field, refinery and pipeline chores.

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SOLE LICENSEE TO MANUFACTURE VACUUM TANKS UNDER U. S. PATENT No. 2522077

PINPOINT your troubles

with a Murphy Tattle-Tale Switch, the Automatic Trouble Shooter. Here is the "watch-dog" that will tell you what caused an equipment shutdown.

The Murphy 101-PH will bird-dog your problem to save you time and labor.

The 101-PH is available on panels or as a separate unit.

Send for the complete MURPHY catalog.

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RANCH ACRES STATION
TULSA, OKLAHOMA

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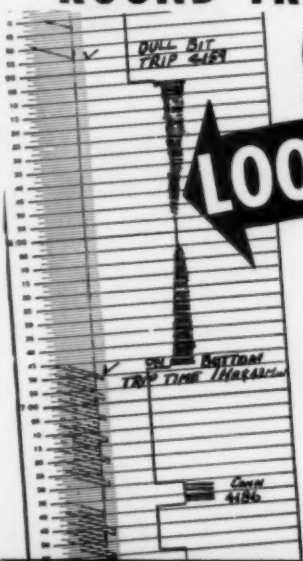
MURPHY SAFETY SWITCH OF CALIFORNIA
11812 Davenport Road • Los Alamitos, Calif.

ROUND TRIP TIME?



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Round Trip Time stands out prominently on a Geolograph chart. The finished charts provide a permanent, duplicate record of tremendous value. Use a GEOLOGRAPH RECORDER the next time you drill or have a well drilled for you, it works for you 24 hours a day. Now available with "TRIP ACTION."

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MONTANA: Glendive, Billings **NEW MEXICO:** Farmington, Lovington
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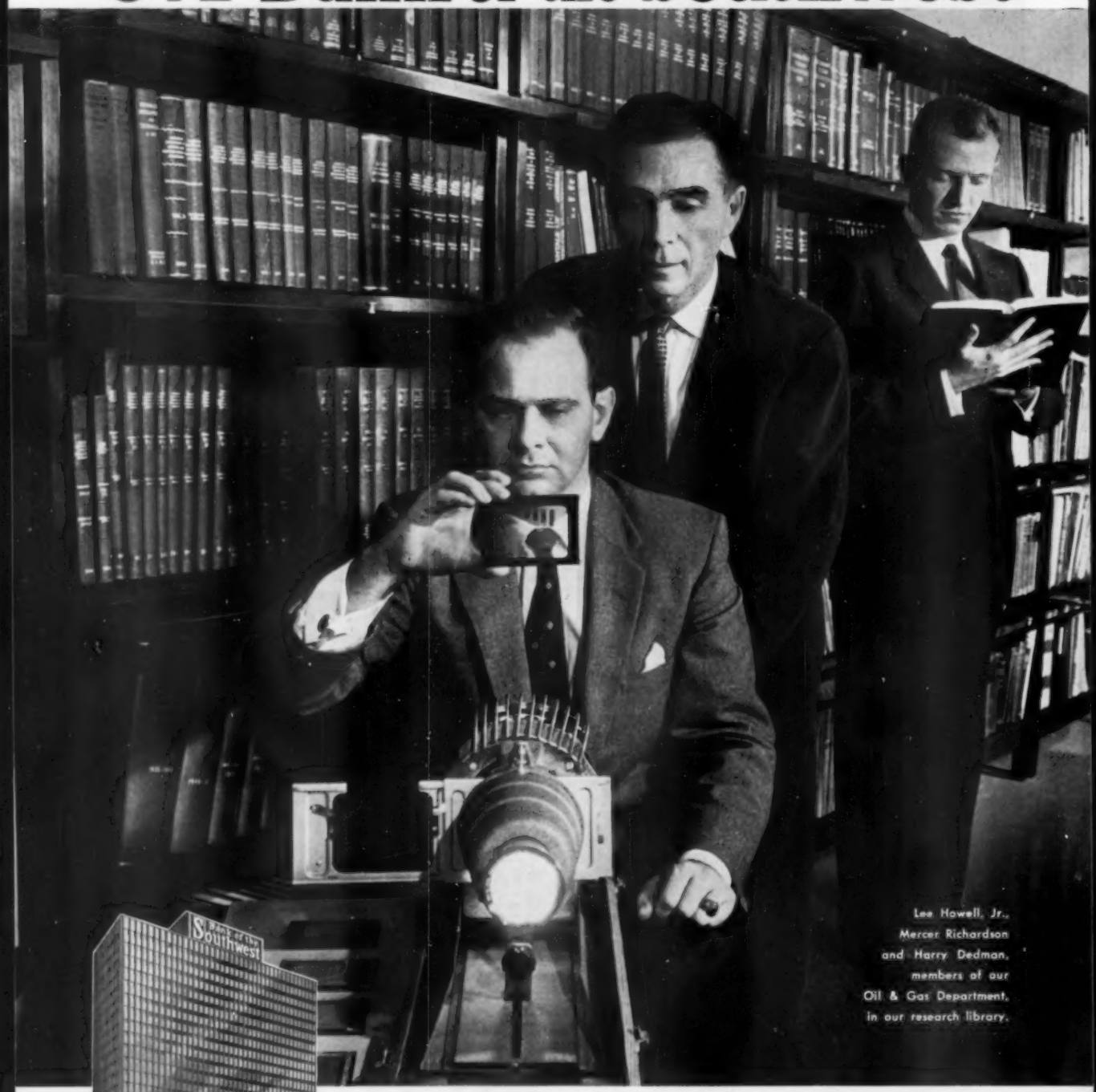
OIL Bank of the Southwest



Lee Howell, Jr., Mercer Richardson and Harry Dedman, members of our Oil & Gas Department, in our research library.

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

BANK OF THE SOUTHWEST offers the ultimate in scope and quality of financing to the petroleum industry. The seasoned members of our Oil & Gas Department were oil men before they were bankers. A large number of our directors and Advisory Committee also are oil men. That's why our bank is known as the Oil Bank of the Southwest. For information, write Harold Vance, vice president and manager, Oil & Gas Department.

BANK OF THE SOUTHWEST • HOUSTON

SHOWCASE . . .

New Equipment

from cold start to saturation temperature, the maker claims. All parts are accessible for service without removing the trap body from the line.

All internal operating mechanisms, including the bucket and linkage, attach to the removable cover. All working parts are either monel or stainless steel for corrosion resistance.

The main orifice is accessible by removing a threaded plug in the top. Condensate entering the trap passes through a monel strainer. Horizontal, straight-through connections are used to simplify installation. Six trap models are available for ½ to 2-in. pipe. **Write or call: Wright-Austin Co., 3245 Wight Street, Detroit 7, for details on 500-C steam trap.**

•

Vapor-pressure apparatus

. . . gives both increased speed and accuracy. Developed by Esso Research & Engineering Co., the Mottlau micro vapor-pressure apparatus is designed to give faster, more accurate tests than the Reid method of measuring the vapor pressure of gasoline and other volatile liquids.

The micro method uses only 1 cc. of sample. Any vapor-to-liquid ratio can be obtained by changing sample size.

The pipet supplied with the apparatus gives a 4-to-1 ratio as specified for ASTM test D-323. Other pipets are available giving 9-to-1 and 24-to-1 ratios. Vapor-pressure values obtained with the apparatus for motor and aviation gasolines, jet fuels, and other petroleum products can be converted to Reid vapor pressure by a simple formula. List price for the complete micro vapor-pressure apparatus is about $3,100. **Write or call: Fisher Scientific, 449 Fisher Building, Pittsburgh 19, for details on micro vapor-pressure apparatus.**

GUARANTEED CAPACITY
CROSBY-LAUGHLIN

"LOAD RATED" TRADEMARK SHACKLES are 50% STRONGER than common shackles!

Size for size, new Crosby-Laughlin* "Load Rated" Shackles are *50% stronger* than common shackles! And you buy guaranteed capacities ranging from ⅓ to 75 tons with the safe working load permanently forged on every shackle.

"Load Rated" Shackles are forged from special steel that has exceptional strength and fatigue resistance. Perfect pin alignment—that distributes stresses equally over the bow—results from drilling pin holes in precision jigs after forming. Heat treated alloy steel pins and bolts in Crosby-Laughlin Shackles are always larger in diameter than the shackle body for additional safety.

Now you can demand—be positive you're getting—*genuine* Crosby-Laughlin "Load Rated" Fittings because they're painted bright RED. It's the quickly recognized symbol of safety *and* the world's most complete line of drop forged fittings for wire rope and chain.

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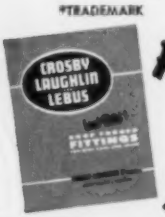

FREE NEW CATALOG . . . lists over 2000 items . . . lets you order Crosby-Laughlin "Load Rated" Fittings the safe way—by capacities . . . includes detailed specifications and dimensional data . . . available now at construction and industrial equipment distributors and mill supply houses—or write direct.

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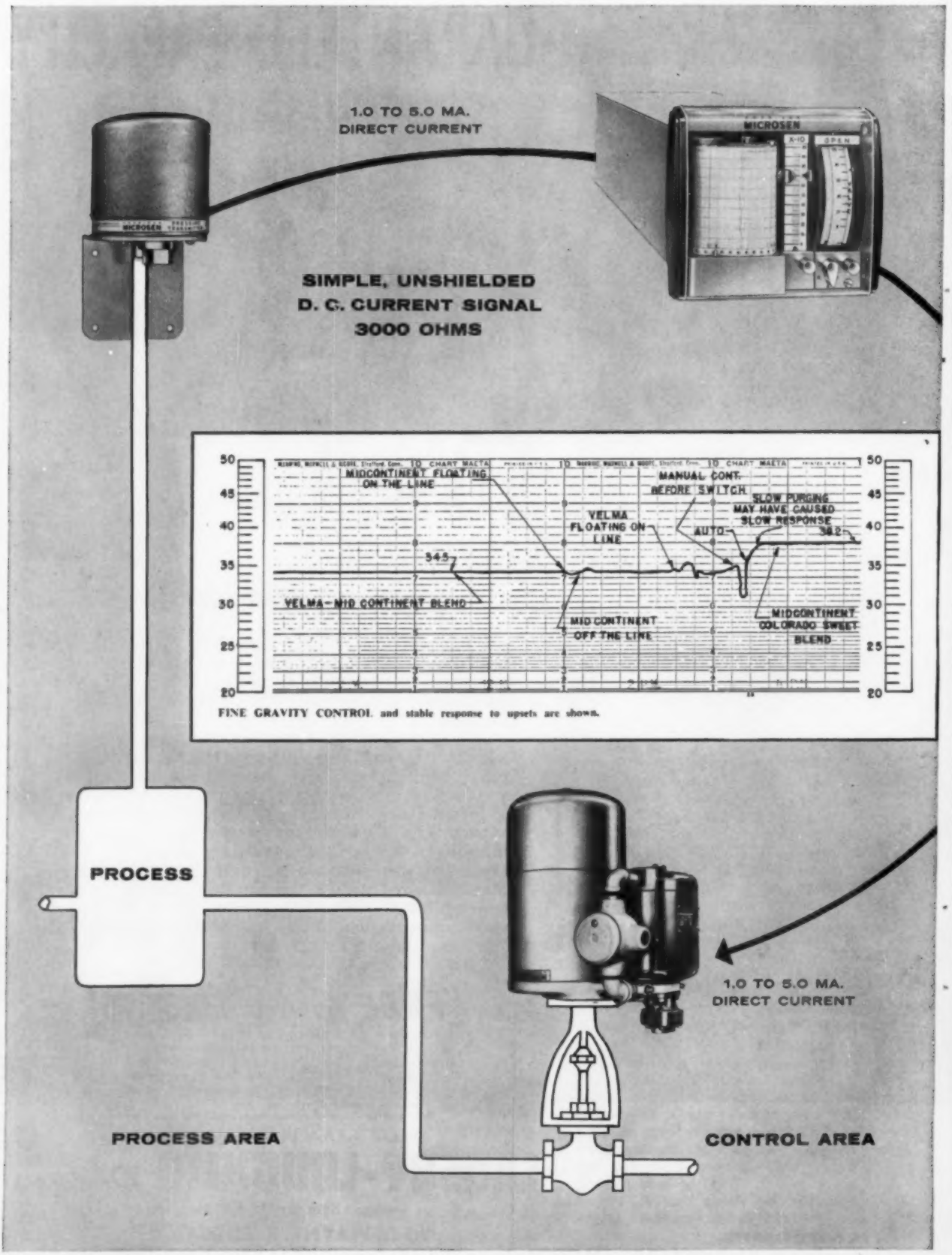

FINE GRAVITY CONTROL and stable response to upsets are shown.

AMERICAN-MICROSEN®

CONTROL-ABILITY

improves process efficiency and stability through electronics

Your company – every company – constantly strives to boost efficiency, process faster, produce more economically. Consequently, hardly a year passes without plant or process improvement.

One of the best, most economical ways to step up product quality and increase quantity is to use improved instrumentation.

Some instrument systems measure and control process variables more satisfactorily than others. But the American-Microsen Process Control System performs better in numerous ways. It is completely electronic. Measurements are transmitted lag-free over long distances, without discontinuities. High accuracy and fast response give you closer control – greater process stability and efficiency.

Better measurement and control are but two advantages of the American-Microsen System. It is more economical to install and operate. It is compatible with almost all data handling or computing systems, and with process stream analyzers being developed.

Make certain you get better process performance. For new plant, new process or revamped old process, use the American-Microsen Electronic System. Learn how profitable it can be in your plant. Write for information or call in one of our sales engineers.

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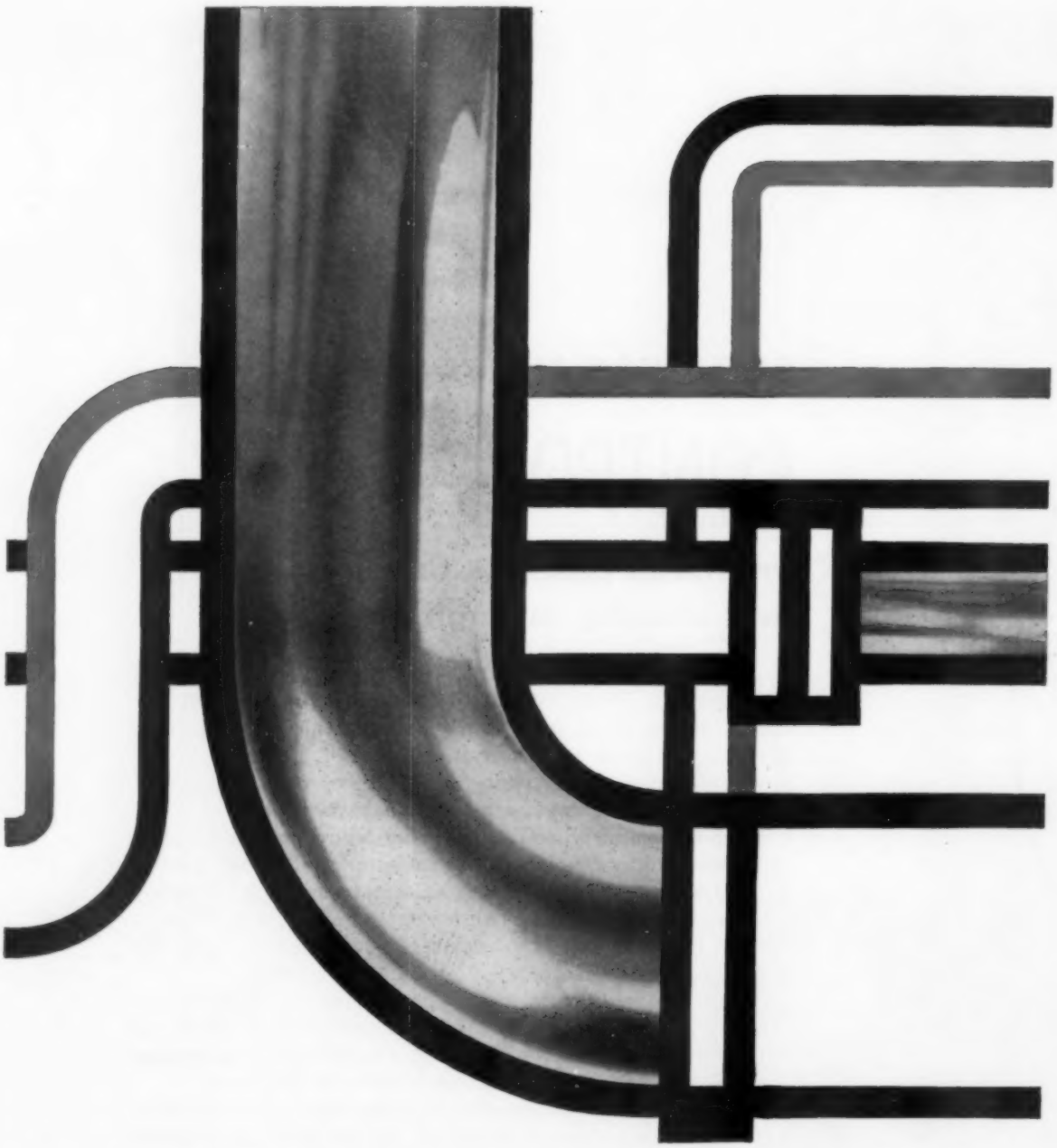
INDUSTRIAL CONTROLS DIVISION • DANBURY, CONNECTICUT

MAKERS OF 'AMERICAN-MICROSEN' ELECTRONIC INSTRUMENTS FOR MEASUREMENT, TRANSMISSION AND CONTROL



win the fight against corrosion—with Alcoa Aluminum

For over 30 years, Alcoa development engineers have successfully employed the outstanding corrosion resistance of aluminum to solve corrosion problems in the process industries. Their unparalleled knowledge of aluminum's behavior in corrosive situations can furnish proved solutions to your most serious corrosion problems. Let Alcoa show you how to *win the fight against corrosion—with Alcoa® Aluminum.* You'll get these extra benefits, too: Light weight • Good workability Low cost • High thermal and electrical conductivity • Great strength in alloys • Non-sparking characteristics • Non-toxicity • Good reflectivity • Clean, attractive appearance.

For immediate help, outline your corrosion problems in a letter to ALUMINUM COMPANY OF AMERICA, 904-E Alcoa Building, Pittsburgh 19, Pennsylvania.

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Alternate Monday Evenings

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Specify Alcoa Aluminum for
corrosion-free Process Equipment
Pipe & Tube
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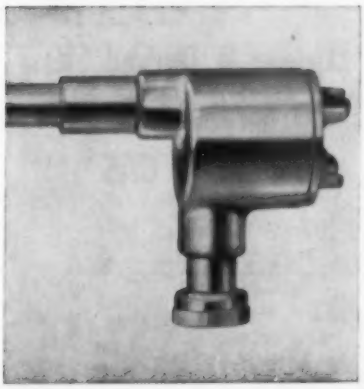


Radioactive sensing element

. . . provides signal for level control. Called Betatrol, the liquid-level sensor is designed to provide an actuating signal to control or indicate a predetermined level. The unit employs beta radiation.

According to the maker, it operates with extreme accuracy and reliability in water, acids, alkalis, oils and viscous liquids. It consists of a small sensing probe that can be connected by up to 200 ft. of cable to an amplifier.

A relay in the amplifier may be used to operate remote warning devices, motor starters, valves, timing devices, and other mechanism to maintain a desired liquid level.

Temperature range of the probe is —65° to 220° F. Probe-operating pressure range is vacuum to 800 psig. **Write or call Robertshaw-Fulton Controls Co., 401 North Manchester, Anaheim, Calif., for details on liquid-level sensor.**

●

Metal building erected

. . . quickly on the building site. It allows floor plans to be changed to meet future needs. The flexible, pre-engineered building is available in clear span widths of 40, 50, 60, and 80 ft. and in multiples of those widths. Eave heights go from 10 to 20 ft. Building lengths are infinite. Twenty-foot column spacing is standard. Sixteen-foot spacing is optional.

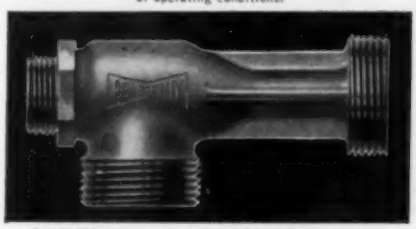
The rigid frame is normally covered with high-tensile-strength, corrugated, galvanized steel. The building can be had with one or more sides open or with drop skirts. Corrugated aluminum or any contemporary exterior masonry treatment is easily adaptable. The new building provides fast, attractive, economical construction for a new shop, plant, or warehouse facilities or expansion of existing buildings, the maker reports. **Write or call: Parkersburg Rig & Reel Co., Building Div., Parkersburg, W. Va., for details on SF Series metal buildings.**

Simplify handling of

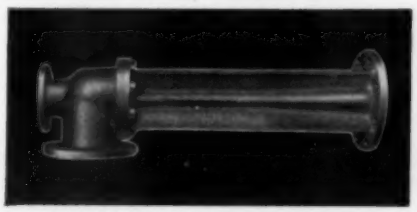
fluids, vapors, gases . . .

and "HOT" MATERIALS

Series 1A and 20A Ejectors perform efficiently over a wide range of operating conditions.



Series 60A fluid operated jet pump for lifting, elevating and blending liquids or slurries.



Special jet pump for handling corrosive chemicals. Stainless steel with flanged connections.

Low-cost, compact Penberthy ejectors provide many unique dependable services in AEC operations, chemical and petroleum processing, power, water and sewage handling and many other industries.

Through long specialized experience, Penberthy has successfully adapted the simple jet principle to a variety of applications. Penberthy ejectors are now incorporated into numerous OEM products; are being used increasingly where mechanical pumps simply cannot be used or are at an economic disadvantage.

They are available in standard, modified and specially designed models from a variety of materials. Worth investigating, Penberthy jet pumps are detailed in Catalog 512R — sent on request.

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MANUFACTURING COMPANY
Division of the Buffalo-Eclipse Corporation
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Series 60P corrosion-resisting Uscolite plastic hydraulic ejector. Rigid. Tough. Lightweight.

Special stainless steel where corrosion resistance and/or non-contamination are required.

PENBERTHY EJECTORS

STEAM, AIR & LIQUID OPERATED FOR:

Liquid Transfer, Heating, Circulating, Aerating, Agitating, Mixing, Pumping, Blending and Exhausting Air or Vapor against High Vacuum.

There's Certain Satisfaction in **PENBERTHY Cycling Jet Pumps • Ejectors Injectors • Electric Sump Pumps**

Catawissa PERFECT SEAL Unions

HOT FORGED from solid, rectangular steel bars, designed and produced for dependable, long-life service under the severest piping conditions!

A TYPE FOR EVERY USE!
FOR ALL PRESSURES!
FOR ALL TEMPERATURES!

Standard & Double Extra Heavy UNIONS

Available with screwed or socket weld ends. 3000-lb. sizes ⅛" to 3"; 6000-lb. sizes ⅛" to 2".

ORIFICE UNIONS

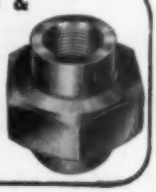
With screwed or socket weld ends. 3000-lb. and 6000-lb. service.

MALE & FEMALE UNIONS

With steel-to-steel, bronze-to-steel, stainless steel-to-steel or orifice seats. 3000-lb. service only.

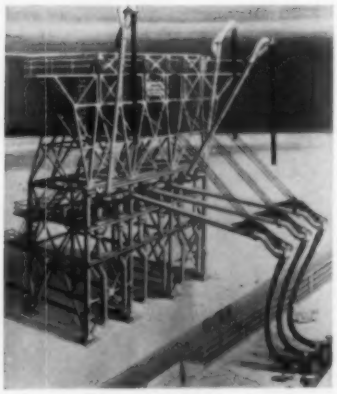
FULL STAINLESS & FULL ALLOY STEEL UNIONS

With screwed or socket weld ends. 3000-lb. and 8000-lb. service.



WRITE FOR CATALOG 58
Showing the Complete Catawissa line of Perfect Seal Products

CATAWISSA VALVE & FITTINGS COMPANY
450 MILL ST., CATAWISSA, PA.



Flow boom eases loading

. . . of tankers through use of push-button control system. The Woodfield flow-boom system, made in England, gives a vertical range of 75 ft. And it provides an allowance for drift up and down the berthing line of 30 ft. in either direction and as much as 10 ft. outward from the berthing line.

These features have been achieved by allowing for luffing through a vertical range of 140° and by giving the boom freedom to swivel through a range of 150°, the maker reports. All seals may be replaced without dismantling the boom. The boom, with hose attached, can be freely moved by hand. Luffing motion is power operated by an electric, air, or hydraulic-powered winch. Optional is an emergency hand-operating gear for use if power fails.

Control of the installation is designed for operation by one man. Movements are controlled by push-button. Duplicate control panels are provided at a level high enough in the structure to enable the operator easily to see a ship's manifold at its highest level as well as at jetty level where the booms may be controlled during the actual period of pumping. **Write or call: Woodfield Hoist & Associated Industries, Ltd., Frindsbury Works, Rochester, Kent, England, for details on flow boom system for tankers.**

●

Electrode for arc welding

. . . puts a hard surface overlay on low-alloy steel and cast iron where severe abrasive conditions are present. The deposit from the electrode is structurally similar to Ni-Hard nickel-chromium alloy. It has the same degree of hardness and abrasion resistance.

The electrode has smooth-arcing characteristics and is operable in all positions, the maker reports. No special techniques for weld-metal deposition are required.

The electrode is used under con-

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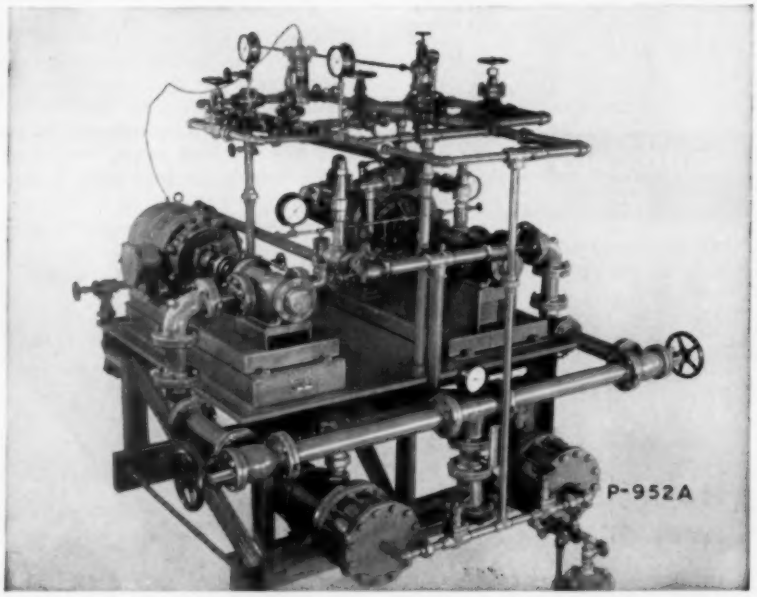

P-952A—Steam Turbine and Electric Motor drive gives flexibility in this compact P-ES2H size and No. 25 unit.

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ditions typical of hard-surfacing applications.

In preliminary field tests on the Inco-Hard 1 electrode, the deposit was overlaid on mild steel. Extensive laboratory investigation of the deposit showed a hardness of 650-700 Brinell for the two-layer deposit. A hardness of about 500 Brinell was typical of the one-layer deposit, according to the maker. The electrode comes in diameters of 5/32, 3/16, and 1/4 in. **Write or call: International Nickel Co., Inc., 67 Wall Street, New York 5, for details on Inco-Hard 1 electrode.**

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Write for technical bulletin

RUBBER & PLASTICS COMPOUND CO., Inc.
10 Rockefeller Plaza, New York 20, N. Y.

Shaft seal has Teflon face

. . . to prevent corrosion of seal parts. The seal is a bellows type of end-face shaft seal. Only chemically inert Teflon is exposed to the liquid being sealed.

Known as Type 20, the seal is designed for use where chemicals would increase the corrosion rate of seal parts made of metal or crystallize and reduce the flexibility of a shaft seal.

The main sealing member is a Teflon bellows integrally molded with a filled Teflon sealing face. Both the sealing-face material and the opposed mating-face material can be varied to suit specific liquids, temperatures, and pressures.

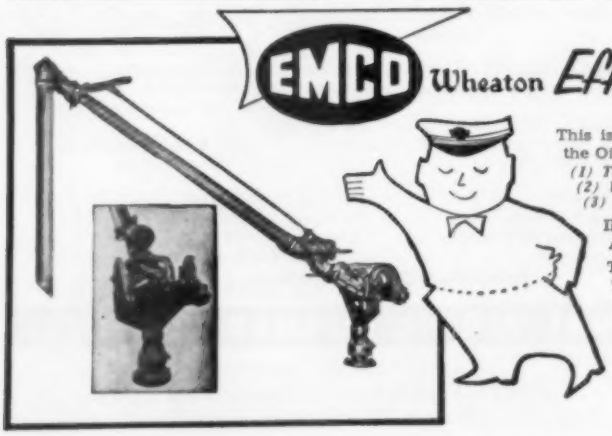
The springs which maintain contact of the sealing faces are Teflon-sleeved. Thus no metal is exposed to the liquid, even when the seal is internally mounted. Available seal sizes are 3/4 to 2 in. **Write or call: Crane Packing Co., Dept. OJT, 6400 Oakton Street, Morton Grove, Ill., for details on new bellows type of shaft seal.**

●

Recorder for well flow lines

. . . tells whether or not liquid or gas has moved through the line. Hy-

EMCO Wheaton *Efficient* **Fluid Handling**



This is but one of the EMCO WHEATON range of products for the Oil & Petroleum Marketing Industry, which includes:—
(1) Truck Tank Valves; Manhole Covers, and Couplings.
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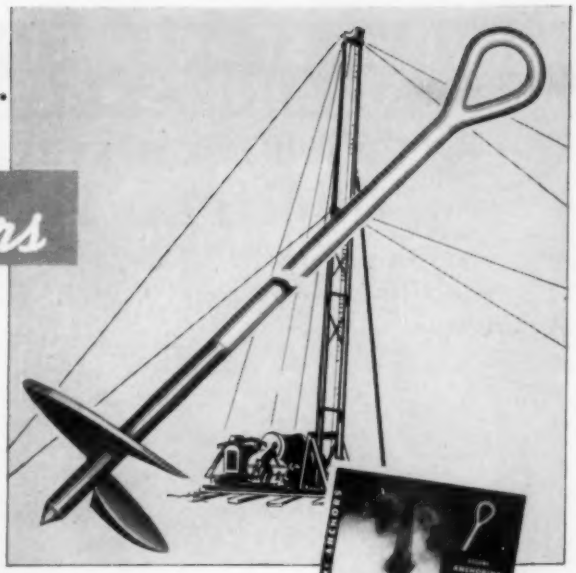

Cut installation cost, save time, make sure your rigs are safely guyed.

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All steel, drop-forged and double arc-welded construction withstands heavy loads, rough use and re-use. Can be retrieved easily or left in place for future use.

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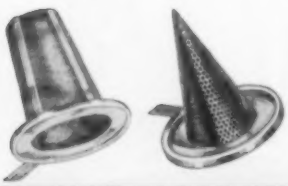
Specialists to the Petro-Chemical Engineering Field for many years MAC-IRON is a producer of temporary strainers, spectacle blinds, spade blinds, and allied equipment which incorporate construction principles, design features, and materials that set them apart as the finest obtainable.



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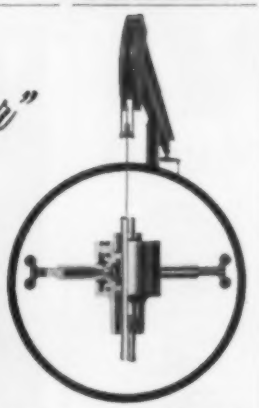
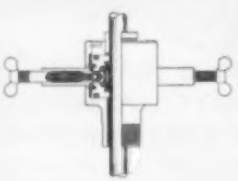
NOW...
"Maximum freedom from wear"
FOR EVERY PUMPING WELL
with KINZBACH "Type 241" Polished Rod Stuffing Box





Compensating for off-vertical movement of the polished rod, gland moves in same direction as rod, and maintains relative alignment with rod. Rod bears only against wear bushing at top of box.

Maximum freedom from wear of rod and tubing, and consequent longer life, is assured by the new, improved Kinzbach "Type 241" polished rod stuffing box with full-floating action.

Free to move laterally to compensate for any "off center" stroke of the rod, the floating gland is packed with a self-lubricated plastic packing. It may be tightened, and additional packing may be added at any time, without shutting down the well. Most wear is taken on the inexpensive, easily replaceable wear bushing.

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SHOWCASE . . .

New Equipment

draulically cushioned, the operating mechanism records and registers well performance by physically recording all fluid or gas movement through the flow line.

Called Well Check, it's adaptable to any capacity pumping well. It employs an API standard stainless-steel rib type of ball and seat. Internal wearing parts are stainless steel.

The maker claims that the tool is silent, nonfluttering, and vibration free. It is cadmium plated for corrosion resistance externally and internally. Fluid movement actuates the counter. Data recorded by the counter indicates if a well is pumped off or if the subsurface pumping equipment isn't working properly.

Molded synthetic packing is used. The mechanism can be removed as a unit. API line-pipe threads are used in the bonnet closure. **Write or call: Fields Machine & Service, 2420 West Alabama, Houston, for details on recorder for well flow lines.**

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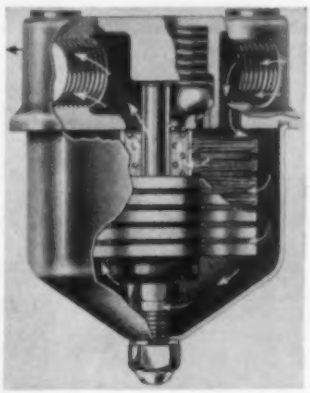
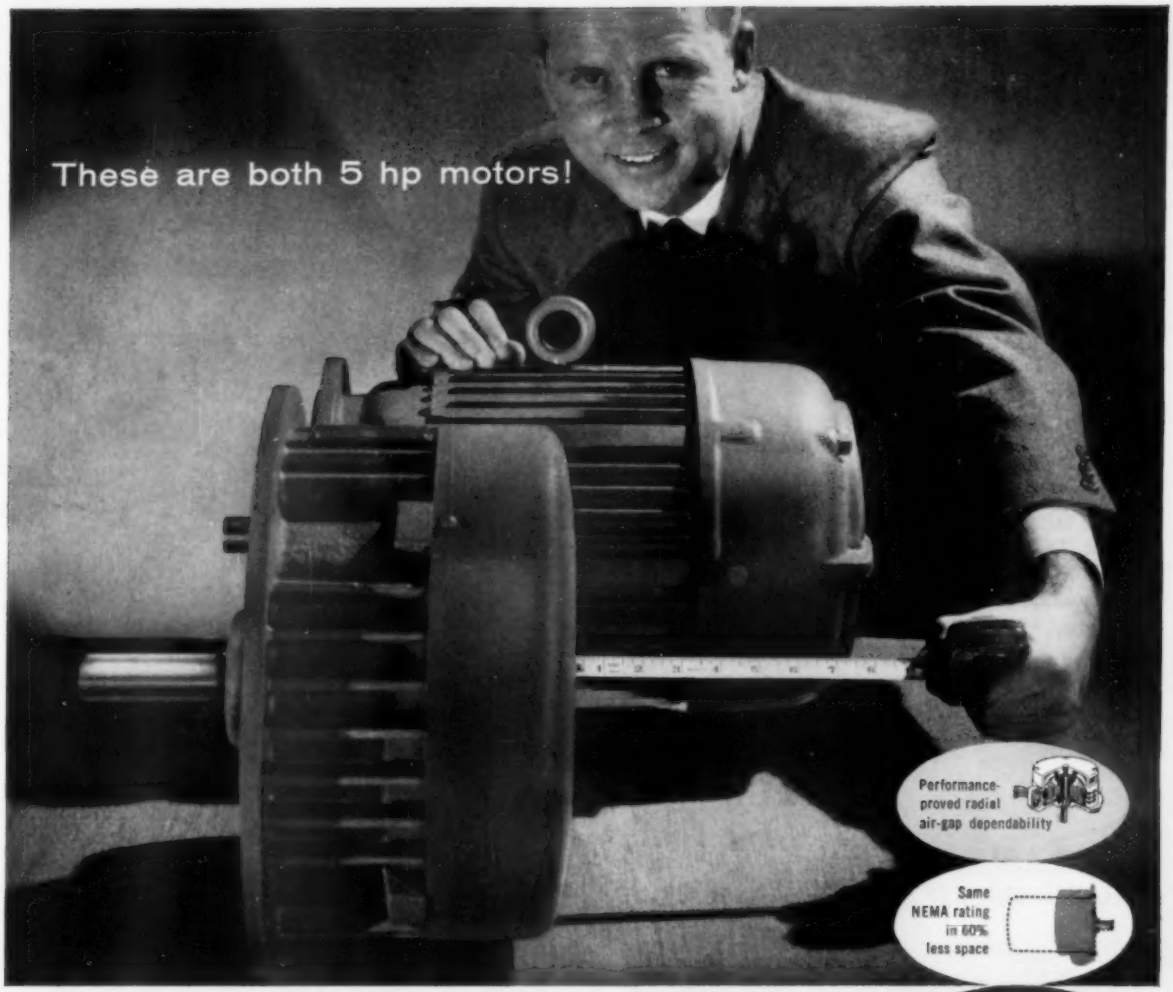


Filter cleans instrument air

. . . with an efficiency of over 95% on particle sizes down to 1 μ, the maker reports. The new instrument-air filter comes in two types. They're designed to remove fine dirt particles and entrained-liquid droplets from compressed-air streams.

The other type uses a metal disk type of filter media. It's used when air temperature at the filter is over 200° F. Particles larger than the wire-screen openings are trapped by fixed openings on the metal disk.

Nominal opening sizes range from 246 to 3 μ. Special materials can be had for corrosive atmospheres. **Write or call: Air-Maze Corp., 25000 Miles Road, Cleveland 28, for Bulletin IAF-856.**



60% shorter– but with radial air-gap design!

New Louis Allis Pancake Motor preserves all the advantages of conventional motor construction

The new Louis Allis Pancake Motor is your solution to trouble-free power in any space-cramped motor application.

The Pancake is a remarkably short flange-mounted motor — up to 60% shorter and 33% lighter than standard motors of the same rating! And it is built in *conventional* radial air-gap design!

It's done by an ingenious forming process which literally compresses the end coils of a conventional radial air-gap motor into an exceptionally short length. The result is a compact, light motor ideally suited for horizontal or vertical mounting on machine tools, roof ventilating fans, or *any* close-quarter installation where space is a critical design factor.

What's more, this is achieved without sacrificing a single desirable characteristic: the stator still contains the same iron and copper as standard Louis Allis motors . . . standard NEMA service factor is maintained . . . high insulative values are retained by using proved Louis Allis varnishes and new insulating techniques . . . over-sized pre-lubricated bearings are used to guarantee long bearing life . . . and the entire motor is enclosed in an industrial-type cast-iron housing designed to shrug off abuse!

SM-101

The housing and flange are cast in one piece: this permits extra-accurate internal machining which extends bearing life and reduces noise levels to a new low.

Investigate the Pancake Motor through your local Louis Allis District Office. Sized from 1 to 15 hp, at 1800, 1200, and 900 rpm, in open drip-proof and enclosed non-ventilated or fan-cooled enclosures. Write for Bulletins 2100 and 2150 to the Louis Allis Co., 449 E. Stewart St., Milwaukee 1, Wis.

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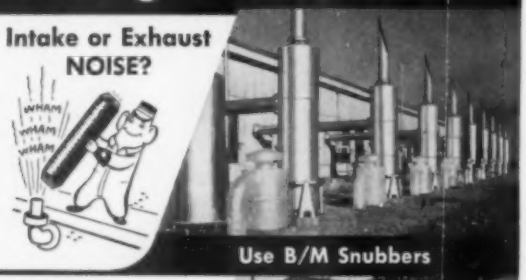
Intake or Exhaust NOISE?



Use B/M Snubbers

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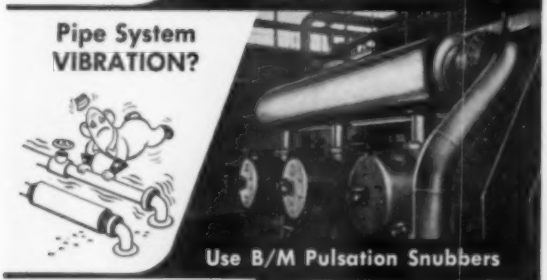
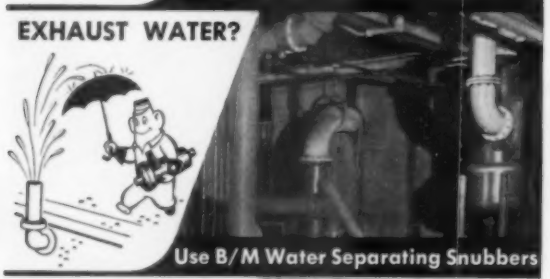


Use B/M Pulsation Snubbers

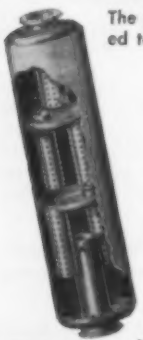
EXHAUST WATER?



Use B/M Water Separating Snubbers

EXHAUST SPARKS?

Use B/M Spark Arresting Snubbers



The Burgess-Manning Snubbing Principle, engineered to your specific problem of:

1. Intake or exhaust noise from the discharge of air, steam or other gases.
2. Pulsation and resulting vibration in pipe systems caused by compressors, vacuum pumps, etc.
3. Water, sparks, or waste heat in your engine exhaust.

WILL EFFECTIVELY CORRECT these costly, annoying conditions.

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Effective "holiday-free" pipe protection

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EASILY APPLIED

Sealtight Pipe Shield is quickly and easily installed by untrained crews. The necessary straps, tools and seals are available and can be shipped as a complete package when desired.

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SHOWCASE . . .

New Literature

Thermometers Catalog C60-2

. . . describes a complete line of rectangular-case, filled-system thermometers. These indicators, recorders, transmitters, and electric or pneumatic control instruments are covered in detail in the new 56-page catalog. Vapor, gas, and mercury-actuated thermometers and thermal systems for use between the temperature limits of —125 to 1,000° F. are listed and explained, along with separable wells and other accessories. **Write or call: Minneapolis - Honeywell Regulator Co., Industrial Div., Wayne and Windrim Avenues, Philadelphia 44, for Catalog C60-2.**

Fire-extinguishing systems

. . . using carbon dioxide, fire-detection equipment, and ultrasonic and photoelectric burglar-detection systems are described in new eight-page Brochure I-19. It contains a chart outlining the suitability of portable fire extinguishers for use on various types of fires. **Write or call: Walter Kidde & Co., Inc., 675 Main Street, Belleville 9, N. J., for Brochure I-19.**

New inhibitor

. . . for corrosion prevention, called Oakite PC 5, is an organic, amine type for injection into the product stream. It's described in a new three-page report. The inhibitor can be used in such units as accumulators, overhead condensers, fractionating towers, feed lines, heat exchangers, and reboilers. The report provides application procedures and data on density, gravity, viscosity, and recommended concentrations. **Write or call: Oakite Products, Inc., 19 Rector Street, New York 6, for Inhibitor Service Report.**

Rotary swivel catalog

. . . is an eight-page booklet that furnishes ratings, lubrication and maintenance, a parts list, and prices on Gray swivels. The parts and price list for the rotary swivel cover 38 items. Detailed information is also included on float valves. **Write or call: Gray Tool Co., 7135 Ardmore, Houston, for Rotary Swivel Catalog.**

New safety check list

. . . designed to help locate the hidden probabilities of electrically ignited explosions in plants is available. The eight-page folder contains a check

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W-S 150 lb. STAINLESS STEEL FITTINGS

Exceptional strength and perfect alignment are features you can rely on in W-S 150 lb. Stainless Steel Fittings. Because they resist corrosion, stand up to extreme heat and cold, they're ideal fittings to safeguard the processes of petroleum, chemical, food and other process industries.

Specify W-S screw-end and socket welding fittings. Available in sizes ⅛" to 4"...in every type you may need. Materials: Stainless Steel types 304 and 316. ASTM-A-182, Grade F-304, F-316 for forged fittings. ASTM-A-296, Grade CF-8, CF-8M for precision cast fittings.

Forge and Fittings Division manufactures a full line of high quality fittings, unions and couplets...in carbon, stainless and alloy steels. For information about them and for your commercial forging and die casting requirements, write to Forge and Fittings Division, H. K. Porter Company, Inc., Box 95, Roselle, N. J.

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1st *to offer a telemetering system that uses only ONE receiver and one communication channel to collect and display variable data transmitted from several different forms of measurement from several locations.*

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- Automatic Tank Scanning

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961-27

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Varec Compton Calif. (U.S.A.) All Codes

list of 13 questions that can help you determine whether uncontrolled materials are making your plant unsafe. An evaluation of the hazard potential in your plant is included, based on your answers, and the findings of the National Fire Protection Association. **Write or call: Crouse-Hinds Co., Dept. HF, Wolf and Seventh North Streets, Syracuse, N. Y., for Hazard Finder.**

Maintenance cleaning

. . . procedures and compounds for pipeline-pumping stations are detailed in new Service Report B 6878. The report describes the use of Satural. It is a diphase solvent detergent which cleans diesel parts by immersion without brushing or scrubbing. The report tells how to remove oil and scale from lube-oil coolers by soaking and from electrical equipment by spraying. **Write or call: Oakite Products, Inc., 19 Rector Street, New York, for Service Report B 6878.**

Industrial liquid meters

. . . Bulletin OG-352 emphasizes a 1-in., 5,000-lb., oscillating-piston type of meter and illustrates its principle. Advantages for the meter include: (1) a flat accuracy curve over the recommended operating range, (2) a full-size chamber permitting normal operation at a lower meter speed, and (3) streamlined flow resulting in low pressure drop across the meter. **Write or call: Meter and Valve Div., Rockwell Mfg. Co., 400 North Lexington Avenue, Pittsburgh 8, for Bulletin OG-352.**

Electronic indexometer

. . . is an in-process monitoring and automatic-control instrument based on the index of refraction. It's reviewed in a new four-page folder. It can be furnished to measure a full range of indexes of all liquids and gases. Highly accurate, the device can be used to monitor in-line mixing, product lines, batch mixing, fractionation, and reaction. **Write or call: Industrial Gages Corp., West Englewood, N. J., for Electronic Indexometer folder.**

Gas purifiers

. . . scrubbers, mist extractors, and separators are described in new Bulletin 600. Four types of scrubbers are catalogued. Type L for light liquid loads and Type LG for heavy liquid loads are for general use. They can be used: (1) in natural-gas processing plants with intercoolers and aftercoolers; (2) in suction lines at compressor stations, and (3) for natural-gas wellhead service. The other two scrubbers, Type

SPECIAL EQUIPMENT for the PROCESS INDUSTRY

AIR HEATERS

Outlet temperatures from 200° to 3000°. Available as a complete unit, or burner unit only. Any required pressure can be met with oil or gas or both as fuels.

INERT GAS GENERATORS

Operating reports on units now in service show perfect CO_2, no excess air, no unburned combustibles, wide turndown, and completely dependable flame stability. Specially engineered to your specifications.

WE MAKE HEAT ... AROUND THE WORLD

The John Zink line of process equipment also includes the famous JZ Smokeless Field Flare, Waste Disposal Units, and more than 50 gas, oil and combination gas and oil burners. Special burners and process equipment designed for your individual application.

JOHN ZINK

COMPANY

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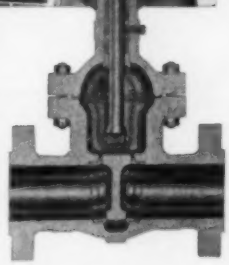
TULSA, OKLAHOMA

*FULL PRODUCTIVITY demands**



Proper design, proper material of construction and uncompromising attention to absolute machining practices are fundamental of good quality and dependability. Dependability is an ally of maximum operational productivity. PACIFIC can give you promise of meeting and maintaining those expected production quotas with valves of shock absorbing toughness, designed for performance and the lasting service you desire.

Proper design of PACIFIC valves includes full open ports with straight thru flow for greater efficiency; close fitting, integrally machined guides in body and wedge for unlimited ease of operation; integrally forged T-Head and stem connection for greater strength and stability; male and female bonnet joints for safety and alignment; deep stuffing box of ample depth to accommodate lantern ring and sufficient packing for an effective seal; lubricated acid resisting yoke sleeve for smoother operation. These and other refinements incorporated in PACIFIC'S valves is your greatest assurance of minimum maintenance and trouble-free operation. And these features are available to you in a complete line of cast steel and stainless steel valves to fit your every service requirement. Whatever your specified service need, you may be sure PACIFIC'S availability of an unusually wide selection of materials and facilities will meet your specifications for quality and delivery dates. Find out more about PACIFIC . . . why it can mean greater profits to you, right now. Write or call PACIFIC for additional information. There is an office near you for your convenience.

PACIFIC VALVES, INC.

Long Beach, California

SUBSIDIARIES: **PACIFIC SOUTHERN FOUNDRIES, INC.** BAKERSFIELD, CALIFORNIA
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PACIFIC FORGE, INC. FONTANA, CALIFORNIA

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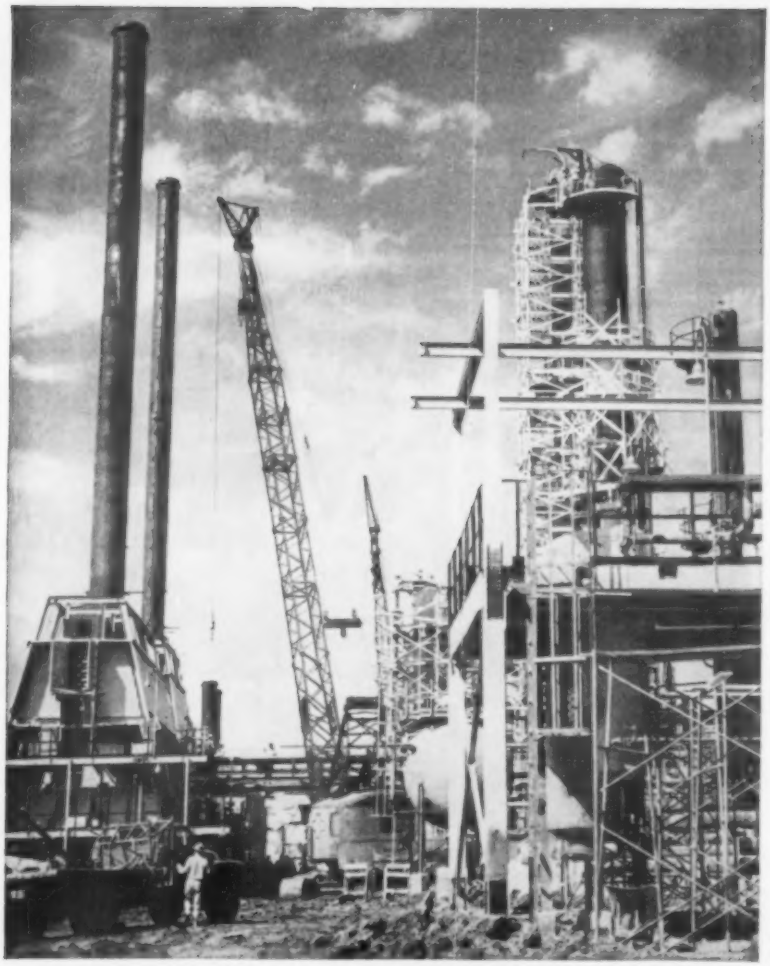

CATS MULTIPLY FAST IN CANADA

Nowhere is Canada's swift industrial progress more striking than in the recent development of its oil refining and petrochemical facilities. Canada's daily refining capacity already approaches 700,000 barrels. New petrochemical plants are rising from coast to coast, to meet the demand for paints, alcohol, ammonia, plastics, detergents, synthetic rubber and other products of petroleum or natural gas.

U. S. executives interested in any branch of the oil and natural gas industry in Canada will find a useful ally, and a prompt, dependable source of information in The Canadian Bank of Commerce. Write or telegraph direct to C. H. Munro, Manager, Petroleum and Natural Gas Department, 309 Eighth Avenue, West, Calgary, Alberta, or to our Business Development Division, Head Office, Toronto 1, Canada.

(*We regret that we cannot advise on the merits of oil or mining securities*)

THE CANADIAN BANK OF COMMERCE

Head Office Toronto 1, Canada

New York • San Francisco • Los Angeles • Seattle • Portland, Ore.
Resident Representative—Chicago and more than 775 branches across Canada

LD and LDW, are dust type of units for use in natural-gas pipelines where a high degree of dust recovery is required. **Write or call: V. D. Anderson Co., Div. of International Basic Economy Corp., 1935 West Ninety-sixth Street, Cleveland 2, for Bulletin 600.**

Baroid distributors list

. . . is a 22-page index to stockpoints of the company's products in the United States, Canada, Cuba, Peru, Trinidad, and Venezuela. The U. S. is broken into four regional divisions and the stockpoints are shown on maps as well as in listings. An alphabetical listing of distributors is included. **Write or call: Baroid Div., National Lead Co., P. O. Box 1675, Houston, for Distributors' List.**

Drilling generators

. . . Bulletin GEA-6692 is a four-page booklet. It features charts, diagrams, and basic application data for the GE752J and GE752K drilling generators. The bulletin supplies specifications, operating characteristics, and features of the generators. **Write or call: General Electric Co., Schenectady 5, N. Y., for Bulletin GEA6692.**

High-pressure screw pump

. . . is featured in new eight-page Technical Bulletin 252. Called Type CB, it's designed for oil services at discharge pressures to 1,000 psig. and viscosities from 35 to 75,000 S.s.U. Selection nomographs, outline dimensions, a sectional view, and details of design and construction are provided. **Write or call: Warren Pumps, Inc., Warren, Mass., for Bulletin 252.**

New steam generator

. . . that's designed as a baffleless, pressurized, two-drum, water-tube packaged unit is described in new 12-page Catalog SB-59. Features of this completely integrated, steam-generating plant are reviewed. It requires no field piping, wiring, brickwork, or special foundation. **Write or call: Erie City Iron Works, Erie, Pa., for Catalog SB-59.**

Shaft-mounted drive

. . . Bulletin 7100 (32 pages) describes a line of all-steel, helical-gear, shaft-mounted drives. They're for applications in the range from ½ to 50 hp. and from 420 to 5 r.p.m. output speed. The booklet tells how to select the proper size and ratio of unit, including new high-ratio units and a new unit for high horsepower. **Write or call: Falk Corp., Dept. 255, 3001 West Canal Street, Milwaukee 1, for Bulletin 7100.**

JET SPEEDBOAT

Record Breaker

Donald Campbell of England is the world's record-breaker for speed in a jet-powered boat. He traveled 225.36 miles per hour in a test on Lake Coniston in England on September 19, 1956.

Meet Another RECORD-BREAKING JET

Security's jet bit S3-J wins increasing favor with Louisiana Gulf Coast drilling contractors.

Drilling Superintendent James Sharon (left) Continental Drilling Company, Inc., New Orleans, aboard one of Continental's drilling barges, "talks it over" with Security's Leroy Guidry.

Says Sharon, "We bought our first S3-J in Louisiana, about three years ago. Our rigs run more than 50% Security. Your rigside service can't be beat; and bit performance matches service." Good reasons why Security is *now 2nd in sales!*

Wherever you drill, experience that plus + bit of Security, product of vanguard engineering . . . sterling quality . . . worldwide uniformity . . . matchless rigside service!

✳S3-J Illustrated

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W. HEMISPHERE: Security International, C.A., Caracas, Venezuela
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Write today for free booklet illustrating and describing 39 record-breaking sports achievements.

Eliminate *high-pressure surges...*
Fill *your casing automatically... and*
Circulate *at any time while running-in with*

BAKER
CIRCULATING
FLEXIFLOW

Now, not only can you fill casing automatically from the bottom while running-in, and protect low-pressure, permeable zones from damaging pressure surges – but you can also *circulate at any time.*

Baker "Circulating" FLEXIFLOW Fill-Up Collars feature a self-adjusting Flow Control Diaphragm that opens up (see Fig. 2) to relieve destructive pressure surges – as high as 5,000 psi – which tend to build up when casing equipped with conventional floating equipment is lowered in open hole. And then, when the rate of lowering is slowed down and pressure from below is reduced, this Flow Control Diaphragm closes down to prevent overfilling; see Fig. 3.

That's why Baker FLEXIFLOW Collars help prevent costly circulation losses . . . reduce mudding-off of producing zones . . . permit maximum recovery . . . and eliminate fracturing as a cause of primary cementing failure.

Surface filling is completely eliminated. Your casing fills *automatically* from the bottom *as it is run.* You can keep the casing moving, except for the short interval required to add and make up a joint.

In addition, you can *circulate at any time* while running-in. And a back-pressure valve can be brought into action for cementing by merely pumping a Bakelite Ball down the casing to the Collar; see Fig. 4.

Ask your Baker service engineer for more information about the successful Baker "Circulating" FLEXIFLOW Fill-Up Collar, and its companion, the Baker Model "E" Triplex Cementing Shoe, Product No. 136-E—a perfect-combination for many "problem" cementing jobs.

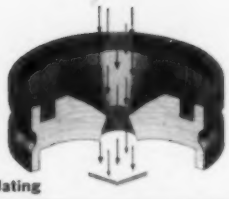


Fig. 1 — Circulating

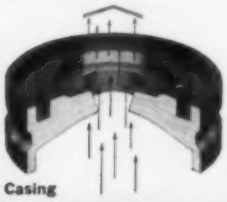


Fig. 2 — Filling Casing

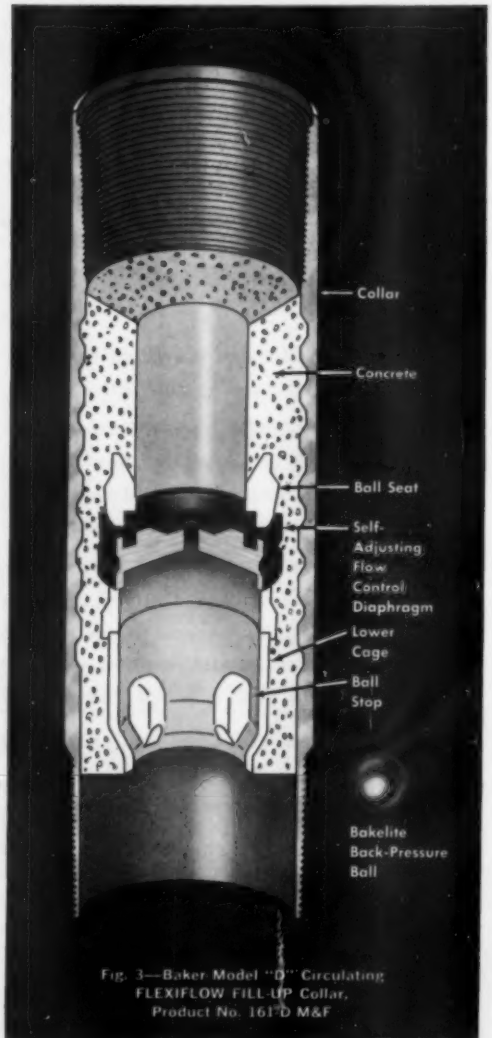


Fig. 3—Baker Model "D" Circulating FLEXIFLOW FILL-UP Collar, Product No. 161-D M&F

Fig. 4— Back-pressure ball dropped and pumped through hole in diaphragm.

Fig. 5— Ball in position to provide back-pressure valve.

BAKER OIL TOOLS, INC.
HOUSTON/LOS ANGELES/NEW YORK

BAKER

First order for 16-in. pipe placed at Edmonton

. . . with Alberta Phoenix Tube & Pipe Ltd. First purchasers of the new pipe size were Hudson's Bay Oil & Gas Co., Ltd., and Canadian Delhi Oil, Ltd.

This pipe will be used as part of the Cessford gas field gathering system in southeastern Alberta. This system will tie into the Alberta gas trunk line which will transport the natural gas to Trans-Canada pipe lines system at the Saskatchewan border.

Universal Wire Products, Inc., opens new warehouse

. . . at Shreveport, La., to serve the oil and gas industry with drilling lines. Frank Ackman, Jr., division sales manager, is in charge of the Louisiana, Texas, Arkansas, Mississippi, Oklahoma, and New Mexico territory. He is an 18-year oil-field veteran. He previously served with Rochester Ripes in this same territory.

Philco Corp., L&N launch joint development program

. . . to design and build a digital computer on a shared cost basis. Presidents James M. Skinner, Jr., Philco, and I. Melville Stein of Leeds & Northrup Co., pointed out that for the first time the broad knowledge and experience of L&N in the process control field is being combined with Philco's knowledge of transistorized digital computers to create a new control system.

The computer which results from the project will be used in industrial process control systems and various military, scientific, and commercial applications.

Presidents Stein and Skinner examine a scale model of the new transistorized digital computer.

Houston Chapter of Nomads hosts foreign guests

. . . at the April meeting. From Canada were Barney Doak, Calgary, and Calvin Jensen, Edmonton. Both are with W-K-M Manufacturing Co. From Buenos Aires, Argentina, is Adolph Iglecia who represents McEvoy Co. in that area. From Tel Aviv in the Middle East is M. Margolin, Israili Water Works.

Alco Products, Inc., elects P. T. Egbert, W. S. Morris

. . . as chairman and as president, respectively. Egbert has been president and Morris was executive vice president.

Egbert joined the company in 1920. From 1921 to 1924 he was technical representative in the Far East. In 1929 he was put in charge of development of a new diesel engine, and was named manager of railway diesel sales in 1934. In 1944 he became a vice president. He was named a director of Alco in 1947 and is chairman of the board of Montreal Locomotive Works, Ltd., the company's Canadian affiliate. Prior to joining Alco he worked for Lehigh Valley and Norfolk & Western railroads.

P. T. EGBERT

W. S. MORRIS

Morris joined Alco as special apprentice in 1922. He worked as a sales representative and later district manager at Chicago. In 1940 he became vice president of Montreal Locomotive Works and executive vice president in 1944. Later in 1944 he transferred to Alco's New York office as vice president. He has been a director of Alco since 1947 and serves on the board of Montreal Locomotive.

Wilson Supply Co. names Sexton and Doughty

. . . as manager of its new store at Monahans, Tex., and to the sales office at Midland, Tex., respectively.

FRED SEXTON

H. DOUGHTY, JR.

Fred Sexton goes to Monahans from Hobbs, N. M., where he was a field salesman. Homer Doughty, Jr., was formerly a field salesman at Victoria, Tex.

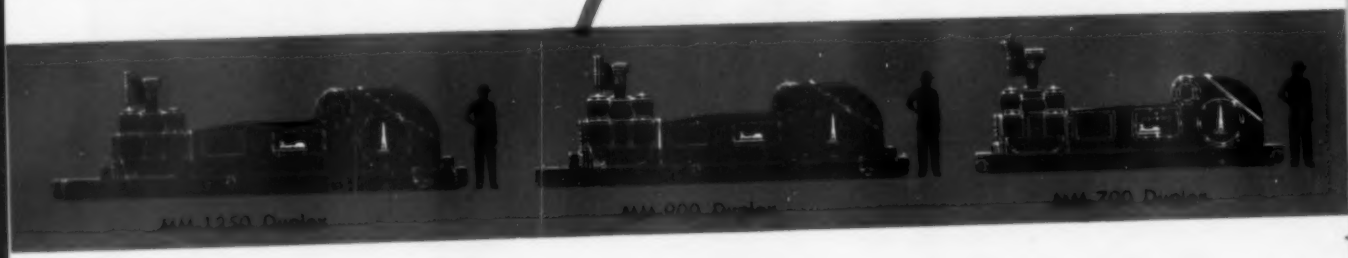
Oil Well Supply Division opens new branch store

. . . at Fort St. John, B. C., reports W. A. Weir, Canadian area manager of the division of U. S. Steel. This store will serve the territory formerly served by the Dawson Creek, B. C., store.

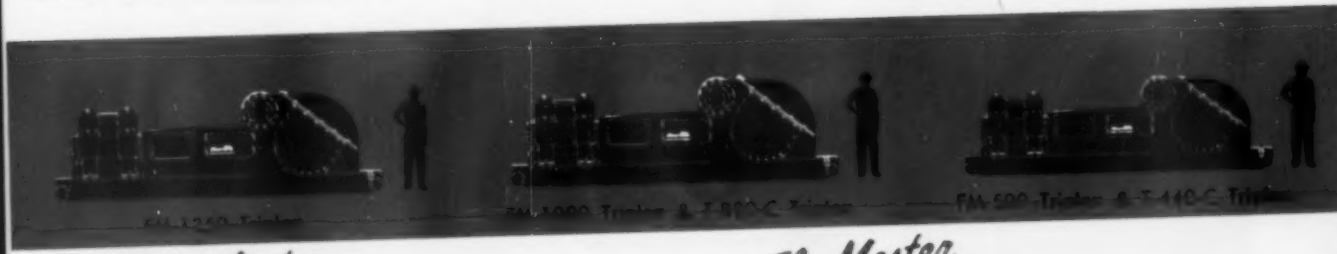
Joseph G. Walsh will be manager of this branch. He was employed in 1952 at Edmonton, Alta. He transferred in 1955 to Virden, Man., and was appointed field representative at Estevan, Sask., in 1956. He was formerly manager of the Dawson Creek store.

Field representatives at Fort St. John are Gordon R. Hill and Douglas A. Ozey. Hill joined Oilwell in 1953 at Dawson Creek and became field representative there in 1954. Ozey was

IDECO'S Big 10 PREVUE..



MODERN AS TOMORROW...



Mud-Master Flo-Master
DUPLEX AND TRIPLEX...

Ideco's 1250 h.p. Mud-Master, Big Brother of the Big 10, is already setting new records. See it in action.

10 All Steel MUD PUMPS

. . . PROVED IN ACTION

H.P. RANGE 175 to 1250

. FOR ALL REQUIREMENTS

. . . developed by the world's most experienced pump team

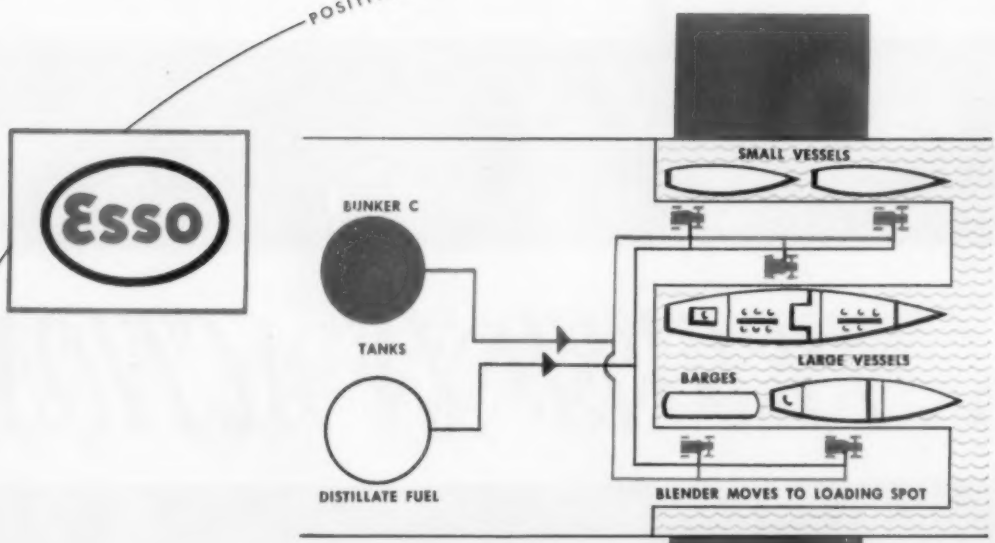
Here are ten more big reasons to keep your eye on Ideco! You have seen recent announcements on many new Ideco engineering advances in masts, drawworks and other components. Remember, too, that Ideco has a team of mud pump developers with more years of experience than any other manufacturer in the world. Through the years this group has pioneered many features that have resulted in greater pump performance and longer, trouble-free service. Take a close look at Ideco's new 1250 h.p. Mud-Master, already setting new performance records, and you will see the same "plus-factor" for you in any of the Big 10 series. Only Ideco offers this wide range of job-rated sizes in Fabriform all-steel pumps. Let's talk soon.

IDECO *Inc.*

ONE OF THE DRESSER INDUSTRIES

POST OFFICE BOX 1331 DALLAS 21, TEXAS

POSITIVE CONTROL OF MATERIALS IN MOTION B-I-F



At Esso's Cristobal Bunkering Station . . .

SELF-POWERED MOBILE BLENDER PROVIDES ON-THE-SPOT BLENDING OF CUSTOMIZED BUNKER FUELS!

Terminal operators can now deliver any desired blend without advance notice . . . with a Proportioneers Mobile Blender. The simplicity and flexibility of this versatile blender have completely revised the economics of bunkering operations.

IT'S SELF-POWERED! No air, steam, or electric lines required. The blend valve is hydraulically actuated by the line fluid.

NO INSTALLATION COST! The Blender can be immediately moved to any loading spot . . . eliminates need for new tankage and costly manifolding.

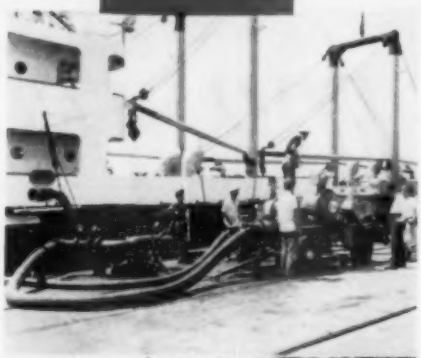
NO CONTAMINATION . . . tank-to-dock lines hold only Bunker C and distillate fuels. Custom blends are made at dockside.

NO SPECIAL PERSONNEL TRAINING REQUIRED . . . operation is this simple:

- move Mobile Blender into position
- hook up *two* component lines and *one* product line
- set ratio control to deliver any intermediate fuel from 90% residual fuel and 10% distillate — to 50% residual and 50% distillate

GREATER ACCURACY! The positive displacement meters accurately register the amount of oil delivered . . . on the spot . . . faster!

Make the move to greater profits . . . request complete data on this unique Blender. Write **Proportioneers, Inc., 377 Harris Avenue, Providence 1, R. I.**



PROPORTIONEERS
DIVISION OF
B-I-F INDUSTRIES
METERS FEEDERS CONTROLS

employed in 1956 at Edmonton and transferred to Dawson Creek as field representative in January 1958.

Chase Brass & Copper Co. promotes three

. . . according to Walter E. Evans, general sales manager of the subsidiary of Kennecott Copper Corp.

Charles W. Baker has been promoted to assistant general sales manager. Allan R. Armstrong moves up from his present position as staff manager, tube, to western regional manager. Robert H. Chittim has been promoted to staff manager, tube.

Baker, who served as western regional manager, will continue to headquarter in Los Angeles, devoting his time to the western and midwestern sales regions. Armstrong will headquarter at the office in San Francisco. Chittim will continue to work out of the main office in Waterbury, Conn.

Mid-Continent Supply Co. forms new division

. . . along the Gulf Coast, President Ken W. Davis has announced. Reorganization of the present Gulf Coast division into two units was made to facilitate closer supervision and to increase service to the oil industry in this region.

R. S. WEILMAN

J. A. Daugherty, Mid-Continent vice president at Houston, will supervise both new divisions. The Houston division remains under Manager R. S. Weilman and now includes Beaumont, Houston Refugio, Falfurrias, Corpus Christi, and San Antonio, Tex.

W. M. DAY

J. O. RAMSEY

The South Louisiana division is under the supervision of W. M. Day, manager, at New Orleans. This division includes Orange, Tex., and Lake Charles, New Iberia, Houma, Morgan City, Harvey, and Delta Tank branches at Lafayette and Westwego, La. Mid-Continent recently was named world-wide (except Mexico) distributor for Delta Tank Manufacturing Co., Inc., oil-field equipment.

Assistant division manager in charge of stores at New Orleans is J. O. Ramsey, former district manager there.

Weilman joined Mid-Continent at Kermit, Tex., in 1937. He was formerly New Orleans district manager. Day is a veteran of 15 years service with the company. He was formerly Venezuelan manager and division sales manager at New Orleans. Ramsey joined the company in 1946. He was store manager at Kilgore, Tex., before transferring to New Orleans in 1956.

Minneapolis-Honeywell Regulator Co. names two

. . . according to an announcement from J. A. Robinson, general sales manager.

Harvey W. Odom has been named sales manager of the industrial branch office in New Orleans, La. Eldred E. Jones succeeds Odom as branch industrial manager at Wichita, Kans.

Odom joined Honeywell in July 1950 as valve division sales engineer in Tulsa. He later transferred to industrial instrument sales at Wichita.

This is what we mean by COOK service!

SERVICE ISN'T JUST A "WORD" to C. Lee Cook Company. To us it means *business*. Overnight ring shipment from Louisville to Texas is just one example of Cook service. We realize, just as well as you do, that "hours are dollars" and a lot of them can be lost while your compressor or diesel engine is forced to sit idle.

And, while we are proud of our service, we know that today's service won't be good enough tomorrow. That's why we're continually working to improve it. Here are some of the things we're doing right now to make Cook service better:

1 Establishing a Cook branch office and warehouse in Los Angeles.

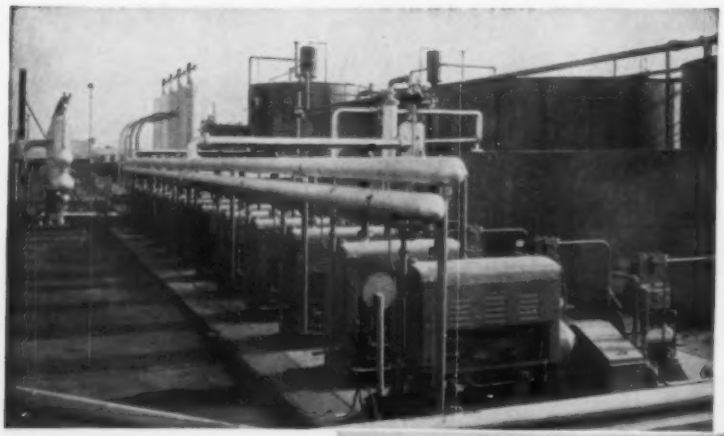
2 Again increasing our staff of engineers at the home office in Louisville.

3 Adding 20% more space for our Louisville manufacturing operations.

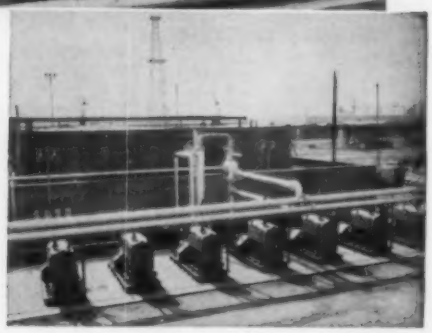
We'd like nothing better than to demonstrate Cook service to you. For information on Cook's complete line of piston rings and packings, write: C. Lee Cook Company, 934 South 8th Street, Louisville 3, Kentucky.

C. LEE COOK COMPANY
Division of Dover Corporation
Rings and Packings Since 1888

WEST COAST OIL CO. PURCHASES SECOND VAPOR PHASE® SYSTEM



Efficiency and Economy of Operation So Successful Eight More Engines to be Vapor Phased



So pleased with the performance of its first Vapor Phase system, installed in 1951, this well-known oil company is now installing a second system to service eight additional engines.

Shown above is the original installation of twelve 45 bhp Minneapolis-Moline engines, all operating on the single Vapor Phase separator seen in the center.

This single unit utilizes the steam output of all twelve engines for power oil heating.

Want more information on how Vapor Phasing can improve the performance, and cut the operating costs of *your* installation?

Write or call for recommendations and estimates. No obligation.

"Sole Developers and Manufacturers of Vapor Phase Thermal Circulation (Ebullition) Engine Cooling."

E C VAPOR PHASE

ENGINEERING CONTROLS Inc.

An Affiliate of St. Louis Shipbuilding & Steel Co.

611 E. Marceau
St. Louis 11, Mo.

1939 N. Hillhurst Ave.
Los Angeles 27, Calif.

He was formerly with Atlas Powder Co. and H. W. Snider Co. of Macon, Mo.

Jones joined the Wichita branch office in 1954 as industrial sales engineer.

Worthington Corp. names J. V. Jirasek

J. V. JIRASEK

. . . as manager of its newly created process industries department in the Harrison, N. J., marketing division. A. W. Fraser, general marketing manager, made the announcement.

Jirasek formerly served as sales manager of Worthington southwestern regional sales organization. In his new post, he will be responsible for strengthening the corporation's relations with its customers in the petroleum, petrochemical, and associated industries.

Jirasek joined Worthington in 1940. He has served as special representative and as manager of the petroleum and chemical industries division. In 1954, he was appointed southwest regional sales manager at Houston, the position he held until his present assignment.

Otis Engineering Corp. introduces new service

. . . known as surface caliper survey which is designed to detect defective joints in either new or used tubing before the pipe is run into a well. The service is recommended for tubing that will set in corrosive, high pressure wells.

A special calipering instrument is drawn through the joint to determine the internal condition of the pipe. This condition is immediately logged, and each joint classified and color-coded accordingly. After the entire lot is surveyed, a corrosion engineer compiles a detailed, permanent report on the classification of each joint.

Collins Radio Co. announces changes

. . . in its sales personnel, according to James G. Flynn, Jr., vice president, sales.

W. W. Roodhouse, former assistant general sales manager, was advanced to general sales manager. R. C. Frost, former assistant to the vice president, international division, has been appointed director of the international division.

W. H. Bigger was named assistant to the vice president of sales; and

COLORS

in fluid form

DYE CONCENTRATES*

by **PATENT CHEMICALS**

the Pioneers in Petroleum Dyes

FOR CLEANER, EASIER COLORING OF PETROLEUM PRODUCTS; ELIMINATES PRE-DISSOLVING, DUSTING, OPERATOR EXPOSURE • LESS SKILL AND EQUIPMENT REQUIRED: INTRODUCED DIRECTLY INTO THE FINISHED PRODUCT • THE ANSWER TO BULK, TANK TRUCK, TANK CAR, BARGE, TERMINAL AND PIPELINE COLORING • CAN BE USED WITH DRY DYE EDUCTOR EQUIPMENT • THE USE OF DYE CONCENTRATE INVOLVES NO ADDITIONAL COST COMPARED TO ORDINARY DRY DYES.

FOR USE IN

Gasolines — Diesel Fuels — Fuel Oils — Lubricating Oils
Automatic Transmission Fluids — Break-in Oils and Greases

Also Available in Dry Dye Form.

Dye concentrates can be prepared to customer specifications.

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Samples and description upon request.

PATENT CHEMICALS, INCORPORATED

MANUFACTURERS OF DYES AND CHEMICALS FOR THE PETROLEUM INDUSTRY

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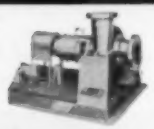

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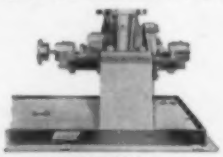

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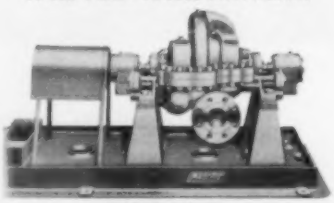

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CP-19

M. W. Burrell, vice president, is now manager of Collins Texas division.

Other changes include the appointment of T. W. Sharpe to assistant general sales manager, and R. M. Winston to assistant general sales manager, administration. T. A. Farrell has been elevated to Texas regional sales manager in Dallas, Tex. G. M. Bergmann to Central regional sales manager in Cedar Rapids, Iowa; and W. J. McKnight to manager of the New York office.

Internal Combustion Engine Institute elects officers

. . . at its annual meeting. L. F. Shoemaker, Allis-Chalmers Manufacturing Co., was elected president. He succeeds F. C. Langston, Jr., P&H Diesel Engine Division, Harnischfeger Corp., who continues as a director. Other officers for 1958 include: A. D. Marks, Hercules Motors Corp., vice president; H. H. Howard, Caterpillar Tractor Co., treasurer; and James V. Doe, Willys Motors, Inc., secretary.

L. F. SHOEMAKER

Cooper-Bessemer Corp. promotes J. R. Craine

. . . to branch manager, East Central district, according to Grant C. Woodard, general sales manager. In his new position, Craine will be responsible for all application and sales of engines and compressors in the East Central area. He will locate at the home office in Mount Vernon, Ohio.

J. R. CRAINE

He was previously sales engineer for Macklin Co. of Jackson, Mich., before joining Cooper-Bessemer 3 years ago as a sales engineer.

Western Co. expands Cortez, Colo., district

. . . to provide acidizing service for the Four Corners area, reports Walter Beadle, vice president, operations-sales. It will function as part of the Oklahoma City division headed by C. E. Wooldridge, division manager.

Acidizing service was added to already existing facilities at the Cortez station. William H. Dennis will continue as district manager of the combined pumping services and wire line operations at Cortez. Ben Hays, sales engineer, will represent Western in both services at Farmington, N. M.

Welex of Canada, Ltd. reports expansion

. . . according to Bruce A. Redwine, vice president and general manager of the company.

Stan Nelner has been named vice president and manager of operations; H. T. Harvey, eastern division manager; and H. J. Fairbanks, western division manager.

The eastern division has headquarters in Regina and operation districts in Estevan and Sarnia. The western division headquarters in Edmonton, with operation locations in Edmonton, Drayton Valley, White Court, Red Deer, Calgary, and Wainwright. Welex of Canada is a subsidiary of Welex, Inc.

McCullough Tool Co. opens eastern division branch

. . . at Ozark, Ark., according to an announcement by O. J. McCullough, vice president.

Charles Lee Cavanaugh, formerly

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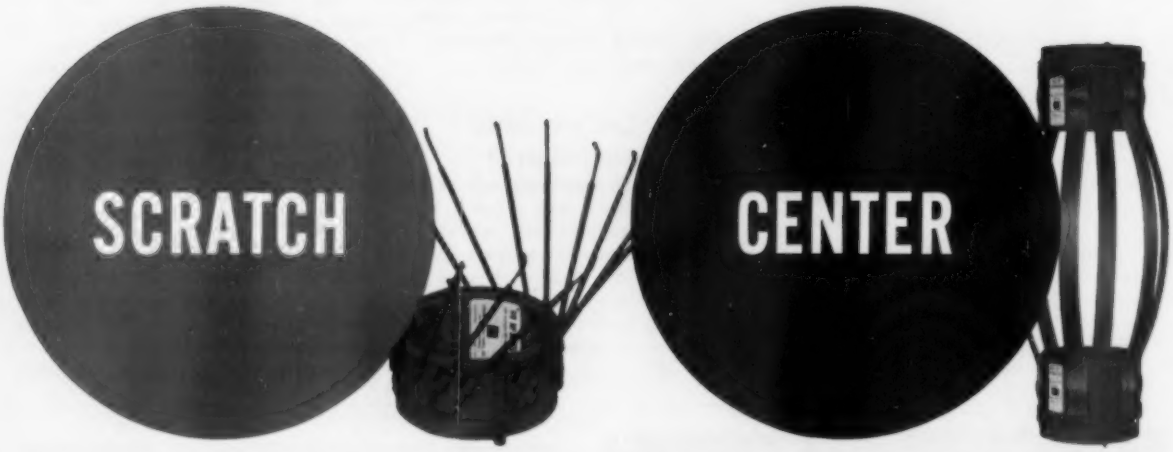

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BJ Centralizers and Scratchers are sold through all recognized supply stores—or see your Byron Jackson field service man or the cementing experts of BJ Service, Inc.

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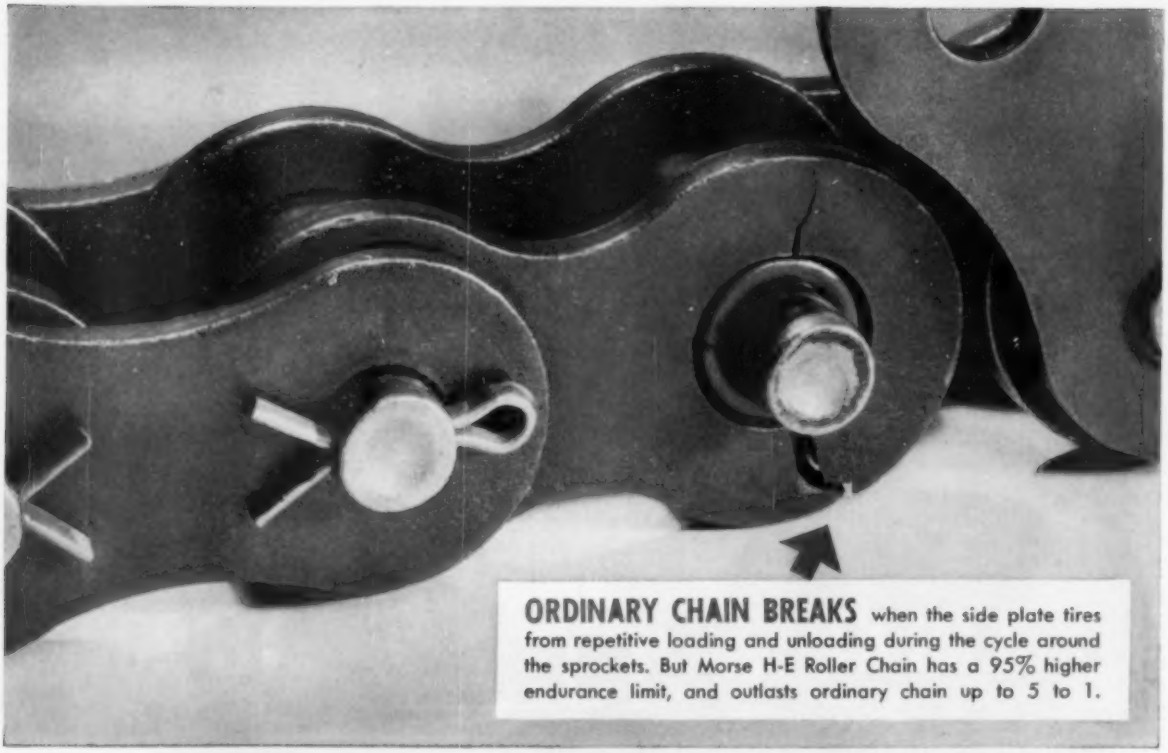

ORDINARY CHAIN BREAKS when the side plate tires from repetitive loading and unloading during the cycle around the sprockets. But Morse H-E Roller Chain has a 95% higher endurance limit, and outlasts ordinary chain up to 5 to 1.

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service unit operator at the Magnolia, Ark., service branch, has been appointed branch manager and is in charge of operations at the new service branch office.

It is equipped to serve the oil industry in the area on a 24-hour basis with all wire line services offered by McCullough.

Texas Instruments, Inc. names Richard A. Arnett

R. A. ARNETT

. . . as marketing manager of the industrial instrumentation division, according to E. O. Vetter, division general manager.

Arnett joined the company in 1954 and formerly was manager of IID's industrial engineering department. In his new position he will direct both domestic and foreign marketing functions of the division. Prior to joining Texas Instruments, he was head of the research and development department of a Dallas instruments manufacturer.

To aid Arnett in his activities, John W. Roby, Jr., has been appointed marketing administrator. He formerly was head of the division engineering applications branch.

IID manufactures geophysical instruments, industrial recorders, and measurement control systems.

Ralph N. Brodie Co. names Paul B. Renfrew

. . . as manager of pipeline and refinery sales for Brodie meters and allied equipment.

P. B. RENFREW

Since joining the company in 1936, Renfrew has held various key positions, including that of chief engineer. He will continue to headquarter at the Brodie offices in San Leandro, Calif.

J&L Supply Division appoints D. W. Speck

. . . store manager at Midland, Tex., according to an announcement from A. G. Bastain, manager, field sales division.

Speck was previously salesman at Hobbs, N. M. He joined the division as a storeman at Best, Tex., in 1935. Since then he has held various sales positions in the West Texas district.

Blaw-Knox Co. appoints J. P. Wilson eastern manager

. . . of petroleum sales for the chemical plants division. He will headquarter in the New York City office and will be responsible for petroleum engineering sales along the eastern seaboard. Wilson joined Blaw-Knox after 12 years with Lummus Co., where he held positions in sales and process and project engineering. His experience also includes 4 years of chemical production, plant construction, plant start-up procedure, and equipment testing with U. S. Rubber Co.

Southern Geophysical Co. elects new officers

. . . at the annual stockholders' meeting held in Fort Worth, Tex.

Dr. Sidon Harris was reelected president. New officers include John L. Bible, executive vice president, and Elmer F. Blake, vice president. Frank Steen of Fort Worth and Mrs. Hazel Dygert were reelected secretary-treas-

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urer and assistant secretary-treasurer, respectively. R. L. Nash was named manager of the New Orleans office.

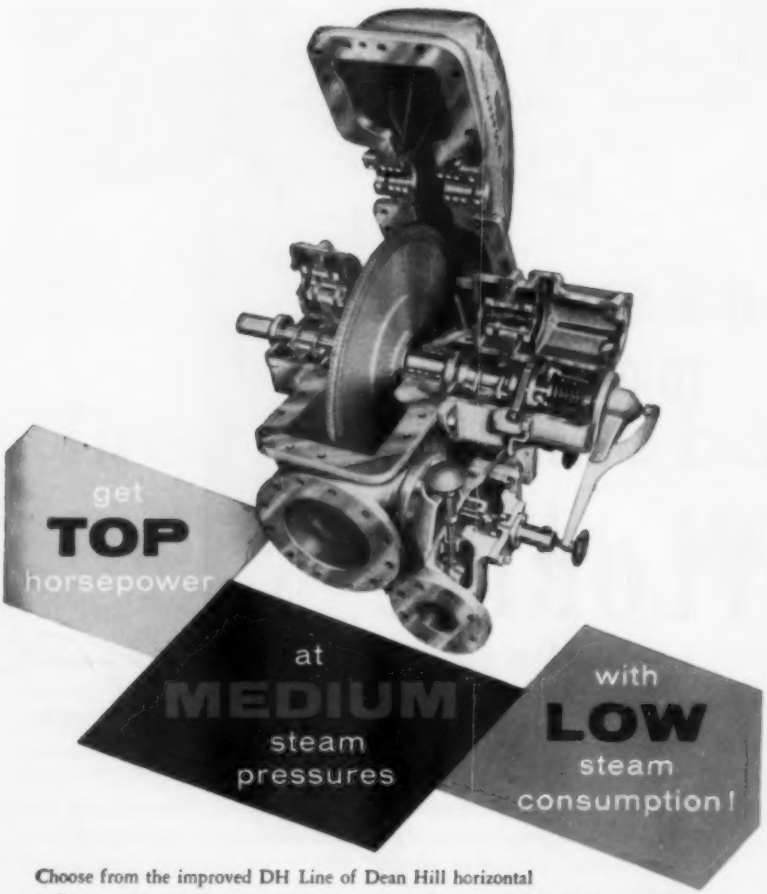
Bible heads the Houston office and has been with Southern for 2 years.

Mountain Iron & Supply Co. plans new construction

Ground was broken in mid-April on the company's new two-story, 14,000-sq.-ft. headquarters building in Wichita. Slated to start by mid-May and opening by July 1 is a new retail store in Odessa, Tex., to serve the Permian basin. The home office building is scheduled for completion by December 1, 1958, according to S. O. Beren, president. Misco offices will occupy the building's second floor and the first floor space will be leased.

The Odessa store will be a 40 by 100-ft. structure. It will have a pipe storage yard.

Lee De Weese has moved from Perryton, Tex., to Odessa to become acting store superintendent. Don Stanton of Augusta, Kans., will be the store manager. Charles Fisher of Pawhuska, Okla., will be head field man, and Richard Popp, Pawhuska, will be field man.



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OFFICES IN PRINCIPAL CITIES

William A. Thompson named resident managing director

W. A. THOMPSON

. . . of Varley-FMC, London, a subsidiary of Peerless Pump Division. The announcement was made by G. F. Twist, vice president of Food Machinery & Chemical Corp. and manager of Peerless Pump.

Thompson, who replaces J. H. Bentley, retired, has been with Food Machinery for 25 years. At the time of his appointment, he was division controller and manager of defense operations at FMC's packing equipment division, Riverside, Calif.

Shaffer Tool Works appointed distributor

. . . for Harold Brown Co., Inc.'s line of production equipment in California, Wyoming, North Dakota, and Colorado, according to Harold Brown, president of Harold Brown Co.

Shaffer maintains sales and service points in Brea, Bakersfield, Taft, Avinal, Willows, Santa Maria, Ventura, and Santa Fe Springs, Calif.; Casper, Wyo.; Williston, N. D.; and Denver, Colo.

Harold Brown equipment includes gas lift valves, surface controllers, and oil and gas well plungers.

John E. Hewson appointed by The Foxboro Co.

J. E. HEWSON

. . . as manager of the New York sales region, supervising instrument sales activities in New York City and sections of Connecticut and New Jersey. He succeeds E. H. Huckman, who recently was named assistant field sales manager.

Hewson served as production control engineer for Dow Chemical Co., and as process research engineer for Texas Research Foundation. He joined Foxboro in 1949 as instrument engineer in the Dallas, Tex., branch and was later appointed manager of the Tulsa branch office.

Replacing Hewson as manager of the Tulsa branch is D. T. McElligott, a Foxboro field engineer at Dallas and El Paso, Tex., since 1953. Instrument users in the El Paso area will now be served by J. M. Flanigan, Jr., formerly of the Dallas branch.

Comfort . . . Vertol 44 . . . Brussels World's Fair

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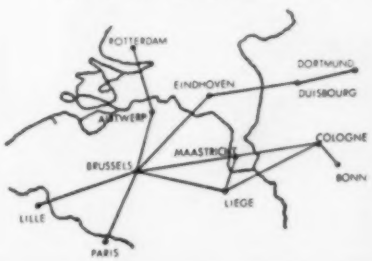

Among the many firsts on show at the Brussels World's Fair is the new multi-city helicommuter service which links the Fair grounds directly to airports in Paris, Rotterdam, Cologne and Bonn. SABENA Belgian World Airlines operates these flights right to the heart of the Fair . . . and Vertol 44 tandem-rotor helicopters play an important part in the operation.

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Vertol 44's are also available as utility transports capable of airlifting up to 19 passengers or 2 1/2 tons of cargo. This version performs multiple duties in petroleum, mining, lumbering or construction.

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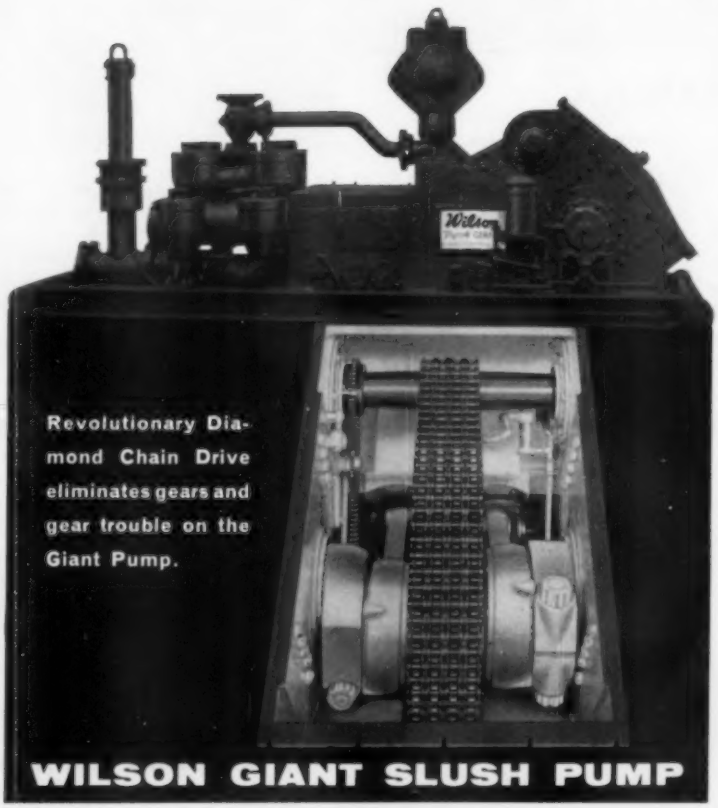
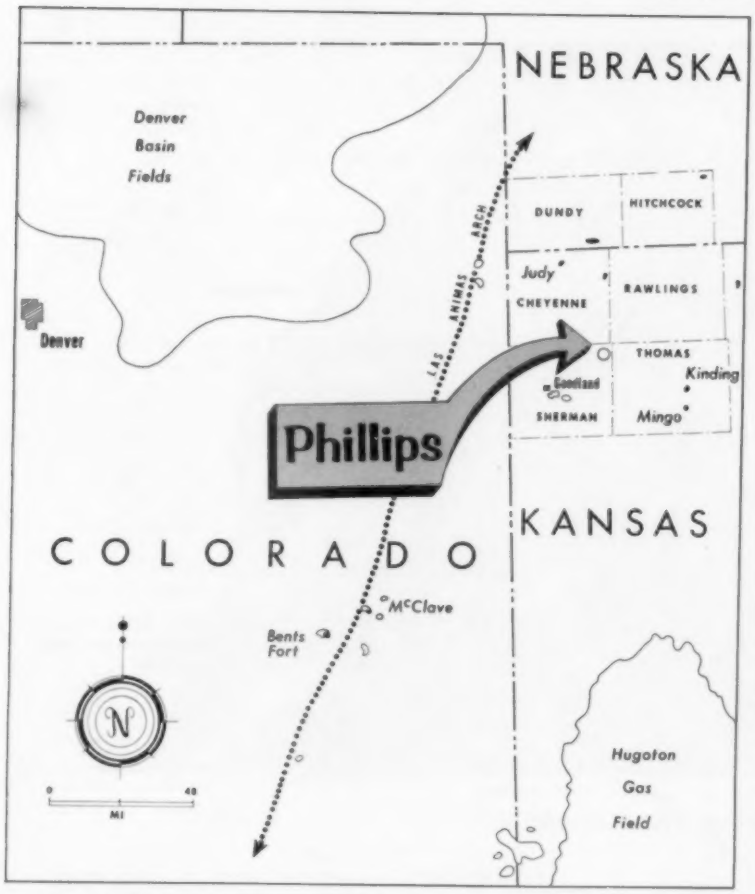




A MAJOR DISCOVERY is taking place in northwestern Kansas' Sherman County, as Phillips Petroleum Co. carries its 1 Llanos deeper to the Mississippian after uncovering five potential pay zones in the Pennsylvanian.

Another strat trap discovered by accident

BY FRANK J. GARDNER

LAST FEBRUARY 10, this column pointed to the small discoveries of oil in Dundy County, Nebraska (see map), as ". . . the forerunners of the really big play that lies in store for the Las Animas arch." In the same column, it was brought out that "These small producers do not make headlines, for it takes a positive indication of really 'big oil' to do that."

The headlines are now here. Just 35 miles south of the Dundy County drilling, Phillips Petroleum Co. has hit at what will likely be the most important discovery in many years for the three-state area embraced by this map.

Interesting headlines . . . Rumors had Phillips 1 Llanos, Section 10-6s-37w, Sherman County, Kansas, flowing 60 bbl. per hour from Lansing-Kansas City (Pennsylvanian) at about 4,300 ft. on May 5. The well was tight, lease men were swarming over Cheyenne, Rawlins, Sherman, and Thomas counties, and overnight, the Las Animas arch hit headlines all over the country. No such lush flow is mentioned in the official details of the discovery, now released by Phillips, but the dope that has been released makes interesting reading and definitely indicates a strike of major importance.

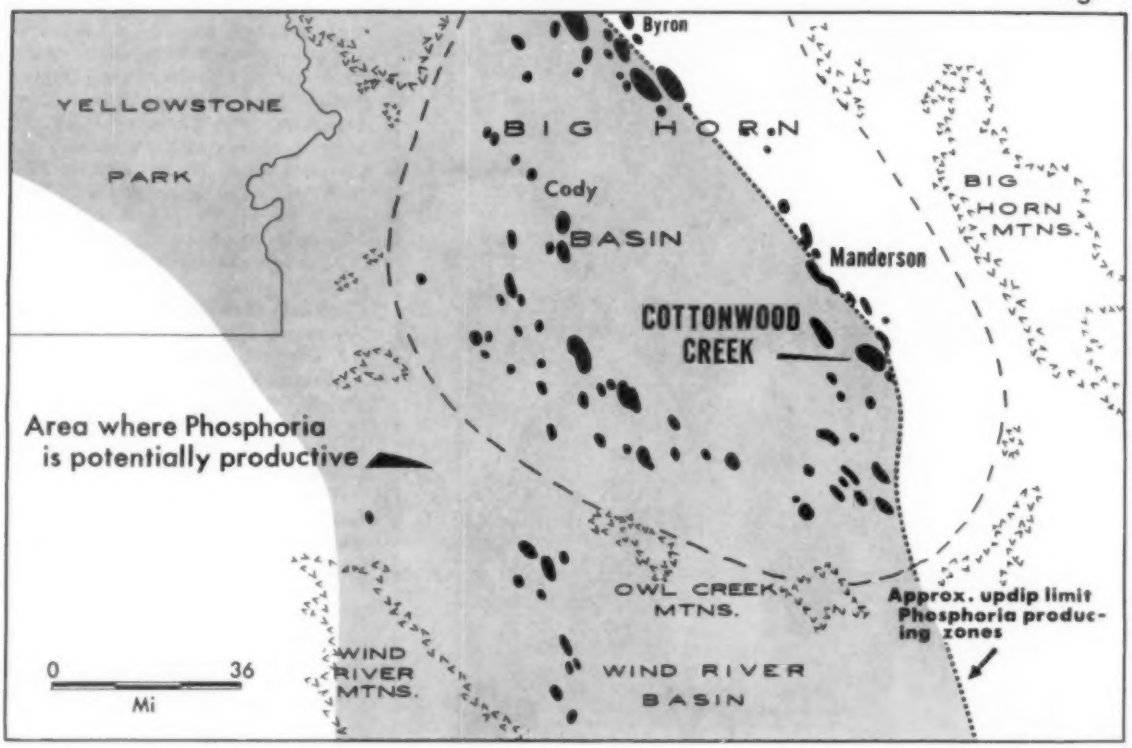
On drill-stem tests, the 1 Llanos recovered commercial amounts of oil from three separate Pennsylvanian groups—the Lansing-Kansas City, Marmaton, and Cherokee—and five separate zones. From Lansing-Kansas City at 4,458-87 ft., recovery was 650 ft. of oil; from Marmaton at 4,594-4,611 ft., 3,290 ft. of oil; from Marmaton at 4,611-18 ft., 3,470 ft. of oil; from Cherokee limestone at 4,772-4,800 ft., 1,821 ft. of oil; and from Cherokee sand at 4,800-33 ft., recovery was 3,875 ft. of oil. None of the tests had any water. No pressures or formation tops have yet been revealed. Oil gravities ranged from 25° to 43°. As this is written, Phillips is aiming the bit at the Mississippian below 5,000 ft.

This interesting new discovery lies in the center of a 22,380-acre block, part of a million-acre spread Phillips holds in western Kansas and eastern Colorado, and flanking the big Las Animas arch. Nearest oil production is 31 miles to the north. The well site is 15 miles northeast of Goodland, Kans., and the old abandoned Goodland gas field. The test was drilled as the third in a series of slim holes ("stratigraphic tests") on Phillips' block. It's in an area of extremely sparse drilling and lies on the northeast flank of the Las Animas arch in the northern reaches of the Hugoton embayment.

And surprising results . . . The operators say they were seeking only geological information, and it must be assumed that the unveiling of 114 ft. of possible Pennsylvanian pay came only as a delightful surprise. To the chagrin of explorationists, most major strat traps are delightful surprises. And there's little doubt that many more lie ahead in this near-virgin Las Animas country. It's heavily leased, and most of the leases have 6 or 7 years to run, but once a drilling play is launched, you can look for a bustle of discovery here, not unlike that now taking place on the western Anadarko basin flank in the Oklahoma and Texas panhandles.

Demand more drilling . . . There are hundreds of millions of barrels of oil hidden somewhere on and off Las Animas in eastern Colorado and western Kansas, but until enough drilling is done to provide some subsurface information for the oil finder, he'll be helpless in the search. For it's all in strat traps. And until the geophysicist perfects a way of finding those traps, nearly every discovery must come as a delightful surprise.

Fig. 1



In Wyoming, questions are being asked about . . .

Phosphoria: will pinchout play expand into Wind River basin?

BY NORMAN S. MORRISEY
Drilling-Development Editor

PICTURE a wedge belt of porosity that extends across the entire State of Wyoming. Add to this innumerable structural noses and huge anticlines that cut across the potentially porous belt. The result is a perfect setup for many large oil fields.

This is the actual situation of the Phosphoria formation in Wyoming (Fig. 1). The real clue to the strat play is Cottonwood Creek, a large stratigraphic trap on the southeast side of the Big Horn basin. The impact of the Cottonwood Creek discovery is only now becoming apparent.

The field was discovered in 1953 by Pan American Petroleum Corp. with the discovery well producing 188 bbl. per day. Two years later production had only increased to 359 bbl. per day. But look at March 1958 when the daily average production was hovering at 14,000 bbl. per day.

Development began in earnest in 1956 with 26 producers completed in that year. Today there are 60 oil wells in the field with 8 dry holes. The dry holes are either updip to the north and northeast or to the south and southeast. These dry holes limit the updip producing area, but the field has been defined neither on the northwest nor on the south.

Tennessee Gas Transmission Co. recently extended the field 2 miles to the southwest, and Pan American Petroleum Corp. pushed the field 2½ miles to the northwest. Its No. 43 unit was completed for 634 bbl. of oil per day and is a long northwest stepout to the producing area. To date Cottonwood Creek has produced approximately 8 million barrels of oil, and the present monthly rate of production is adding about ½ million barrels per month.

What controls production? . . . Cottonwood Creek is a strat trap. The porous Phosphoria limestone, actually a dolomite, grades updip into a nonporous section. Geologists have long known that the porous marine Phosphoria actually pinched out updip into an evaporite shale limestone sequence that was nonporous. But it remained for Pan American Petroleum to pin down the productive porous belt.

Is Cottonwood Creek unique? Emphatically no. This updip porosity pinchout could occur anywhere along a rather narrow zone that extends from northern Wyoming across the Big Horn basin into the Wind River basin and probably extends southward and westward across the Red Desert and Washakie basins and into extreme northwestern Colorado and northeastern Utah.

Any place along this belt, potential strat traps may exist. The real problem for the petroleum geologist is to find a structural nose that cuts across the postulated pinchout. Conceivably Cottonwood Creek is the first in a series of Phosphoria strat traps, and any one of these could blossom into a major oil reserve. (Fig. 2.)

These oil fields will not be found overnight, of course. In many areas there is not sufficient well control to pin down accurately the porosity pinchout, and along the wedge belt of porosity there are places where the Phosphoria is too deep to be economic. The problem for the petroleum geologist is to find another "Cottonwood Creek setup"; in short, a location where porous limestone grades updip into a nonporous section at economic drilling depths on the flanks of a known structural feature.

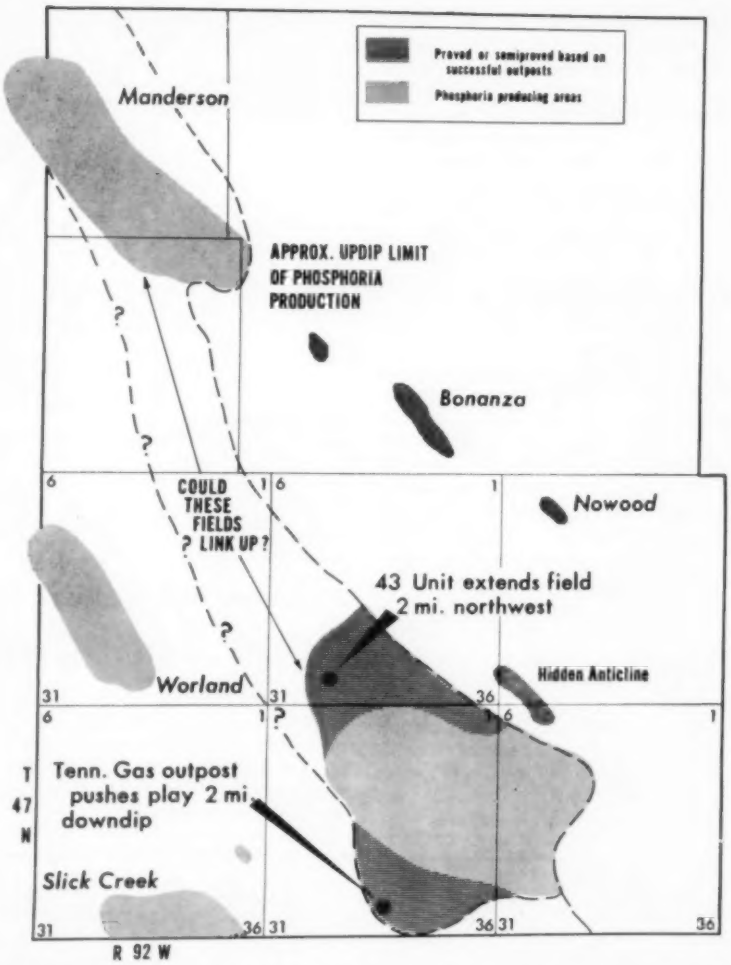
Geology

At Cottonwood Creek the Phosphoria reaches a thickness of 260 ft. John J. Pedry (AAPG Bulletin, Vol. 41, No. 5, May 1957, pp. 823-38), terms the producing zone the "E" zone. He correlates this as roughly equivalent to the Ervay tongue. Pedry demonstrates that the porous dolomite in the producing area grades updip to red shale and anhydrite in the dry holes.

The dolomite in the "E" zone, according to Pedry, is tan to light gray, oolitic, fossiliferous, fractured, and has vuggy porosity. Below this porous section, the Phosphoria consists predominantly of red shale, anhydrite, and thin dolomite stringers. Both McCue's and Pedry's work indicates that, locally in the Big Horn basin, there are several porous zones within the Phosphoria that grade updip into tight and barren red shale and anhydrite beds. Thus the possibilities appear excellent for innumerable strat plays if the traps can be isolated. Regionally the play could extend across West Central Wyoming.

Phosphoria production . . . Within the Big Horn basin and other Wyoming basins, Phosphoria production is usually related to structure. The Phosphoria can be a lucrative pay zone. At Hamilton Dome, for example, it has produced in excess of 5,000 bbl. per acre, and at Little Buffalo basin, the Phosphoria will ultimately yield an estimated 7,380 bbl. per acre.

Actually, Phosphoria production at Manderson provided the clue to the strat play at Cottonwood Creek. Manderson is a large structural feature that trends northwest-southeast. The Phosphoria discovery was drilled in 20-50n-92w in 1951. Subsequent



HOW BIG will Cottonwood become? Recent tests have extended the play northwest and southwest. Conceivably Manderson and Cottonwood Creek could link up to form a gigantic strat trap. Conditions are very similar in both fields since both are Phosphoria strat traps. Fig. 2.

drilling and detailed geological studies indicate that Phosphoria production at Manderson, too, is stratigraphic in nature.

Phosphoria production at Manderson lies 18 miles northwest of Cottonwood Creek. An interesting question arises immediately: Could these two fields be producing from a common reservoir and ultimately join up?

If subsequent drilling did link these two fields, it would be one of the largest oil fields discovered to date in the Rocky Mountains. At present, however, the two fields are separated by a distance of 11 miles which as yet is not producing. Drilling alone will determine the Phosphoria potential of this area.

A near miss . . . The detailed geological study of Manderson led Pan American Petroleum Corp. to acquire acreage on the flank of Hidden Dome and to drill the initial test. The well logged 59 ft. of dolomite predominantly dense with scattered vugs and oil staining in fractures.

At the top of the section there was a 6-ft. porous zone and a second 4-ft. porous zone near the bottom, both oil stained. A drill-stem test of the entire section covered only 30 ft. of mud.

Pan American, however, ran pipe and finally completed the well for 188 bbl. of oil per day after extensive tests. The No. 2 well had a section very similar to No. 1 but the vugs were filled with anhydrite, and the well was finally abandoned.

The third test, too, was a disappointment. It was drilled too far updip and found nonproductive "red facies" in the Phosphoria. It lay east of the updip productive limits. A restudy of the subsurface geology and stratigraphy led to the drilling of the No. 4

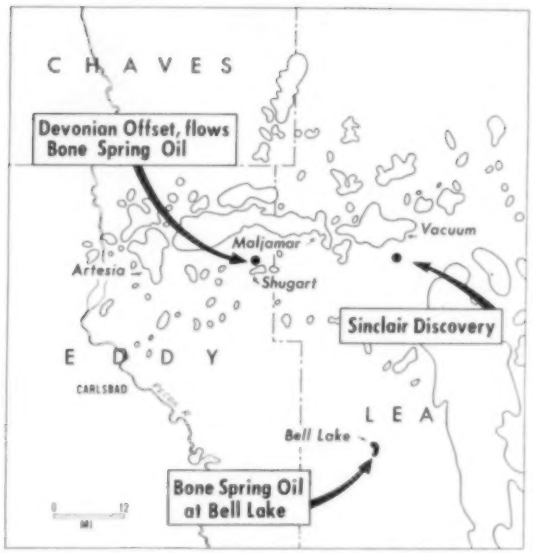
well, completed for 956 bbl. of oil per day.

Could Cottonwood Creek be a reef? There is some evidence that indicates it could, but many geologists feel that it is a porosity pinchout rather than a reef. Later drilling will prove or disprove their theories.

Cottonwood Creek was a near miss. From an economic standpoint the first three wells were practically a failure. Had it not been for the persistence of an aggressive and progressive oil company, a major oil field would have been written off as one oil well, one noncommercial well, and a dry hole, possibly to have been discovered at some later date.

But persistence at Cottonwood Creek has brought its own rewards in the form of a rapidly expanding oil reserve. It has touched off an exploration play that covers West Central Wyoming. It has turned many Rocky Mountain oil finders to the quest for the elusive strat trap.

Phosphoria production at Cottonwood Creek helps disprove the adage that we are running out of oil. There must be many more similar Phosphoria producing areas. And it is a simple matter to use the same line of thinking on many other potential pay zones in both the Rocky Mountains and other parts of the United States.



ONE COMPLETION and one well flowing on test have stimulated interest in the Bone Spring formation of the Delaware basin.

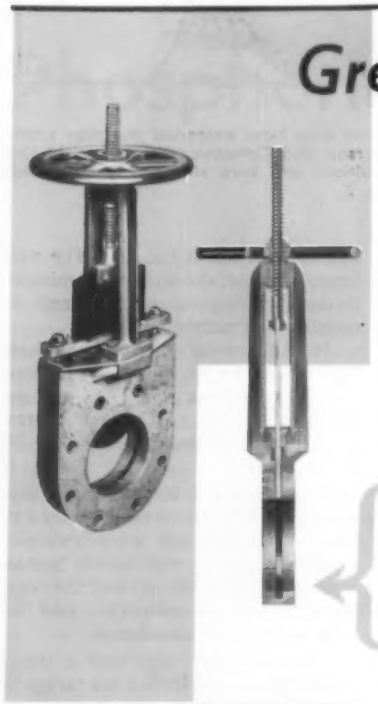
Southwest New Mexico's

Bone Spring quits teasing

BONE SPRING oil in the Delaware basin has always been found in teaser quantities—up until now. Last week a Pan American Petroleum Corp. well made a heavy flow of oil from the Bone Spring formation.

The well was started as a confirmation attempt to the firm's Siluro-Devonian discovery in Sugart field of Eddy County, and drilling continued after the flow test.

A couple of weeks ago Sinclair com-



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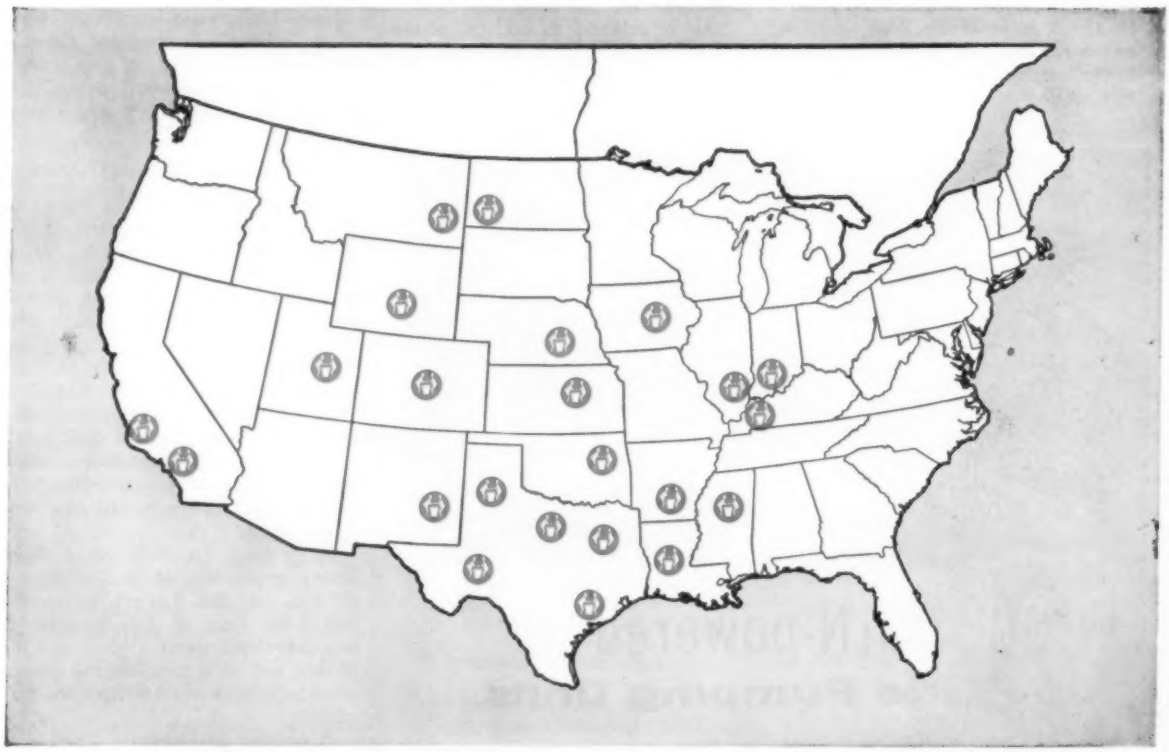

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pleted a high-potential Bone Spring discovery some 25 miles to the east, in Lea County.

Geologically, both tests are in the northern limits of Delaware basin, in what has been called the Capitan reef province. They are south of the Artesia - Maljamar - Vacuum trend of fields.

The Bone Spring is composed of sands and dark limestones lying at the base of the Delaware Mountain group. In age it is lower Permian, a thick section in the basin, and corresponds to the Leonard group. In West Texas, this section is made up of the San Andres, Clear Fork and Wichita members.

Pan American's Test

Pan American Petroleum Corp. 3 Greenwood was drilling at 8,145 ft. with air when it found a show of oil. At 8,165 ft. the hole started filling with oil. It then flowed through casing, and ½-in. choke. In 12 hours the well flowed 248 bbl. of 39°-gravity oil, and in the next 24 hours gaged 451 bbl. of oil.

This is believed to be one of the highest recoveries of Bone Spring oil. On the test, gas-oil ratio was 835:1 and casing pressure was 100 psi.

Operators then switched to mud and drilled ahead. At 8,460-8,594 ft., still in the Bone Spring, recovery in 2 hours was 20 ft. of drilling mud with no shows.

Location of 3 Greenwood is 27-18s-21e, 12 miles southwest of Maljamar. The project was started as a confirmation attempt to 1 Greenwood, Siluro - Devonian gas - distillate discovery ½ mile to the south. Drilling is slated to 14,000 ft.

No. 3 Greenwood is reported to be 40 ft. higher on structure than 1 Greenwood. The No. 1 was drilled with mud, and reported only slight shows in the Bone Spring, which were not tested.

Sinclair Discovery

Sinclair Oil & Gas Co. 1 State-Lea 403, in 22-18s-35e, completed recently as a Bone Spring discovery. Potential was 179 bbl. of 34°-gravity oil in 9 hours, through 24/64-in. choke. Calculated daily potential was 477 bbl.

The discovery is 1 mile west of Pennsylvanian production and 2½ miles northwest of a Devonian discovery in South Vacuum unit.

From these two discoveries it seems the Bone Spring may become commercial, but its previous record has been discouraging.

At present the only other Bone Spring production is at Continental Oil Co. 3-C Bell Lake Unit, in the Bell Lake field of Lea County. It was completed about 3 years ago for 53 bbl. of oil a day, on the pump, after large acid treatments of the formation.

A number of Delaware basin tests have had oil shows, or have produced small quantities of oil from the Bone Spring. Reeves and Pearl fields, both in Lea County, for a time had production from the Bone Spring.

One other current test has flowed Bone Spring oil. This is Jake L. Hamon 1-A Texas-Gulf-State, in 27-18s-35e, in the area of Sinclair's discovery. A drill-stem test at 9,060-9,118 ft. had gas in 7 minutes and oil in 2 hours and 20 minutes.

Thirty-minute gages were: 17 bbl. oil, 18.4 bbl. oil and 15.2 bbl. of oil, plus 44 bbl. reversed out of the pipe. Flowing pressure ranged from 1,495-2,115 psi., increasing to 1,970 psi. in 30 minutes. Gas volume was estimated at 500 M.c.f. per day. A second test at 9,200-9,320 ft. had no shows. Last week the well was at 10,966 ft., preparing to core.

Results of these tests and discoveries are not conclusive, but they will give Delaware basin operators another zone to shoot at, and call for more careful testing.

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Developments in Wyoming:

Good

AN IMPORTANT Parkman-Cretaceous oil discovery was completed in the Powder River basin by Davis Oil Co.

Davis 1 Federal, 5 miles northwest of Dead Horse Creek field, Campbell County, Wyoming, made 456 bbl. of oil daily on pump from perforations at 6,680-6,700 ft.

This new Davis well is the first important Parkman discovery since Dead Horse Creek field was opened. Its success will push the Parkman drive further into the center of this vast Wyoming basin.

And in southwestern Wyoming . . .

Big Piney field in the Green River basin of southwestern Wyoming added what may be its biggest gas well last week.

Gulf Oil Corp. 9 Tresner-State, C NE NE 36-29n-113w, Sublette County, flowed 58 M.M.c.f. of gas daily from the Almy sand (Tertiary) at 2,684 to 2,862 ft.

This big new gas well is at the south end of the field.

And Fremont County . . .

AN OLD AND PROLIFIC Wyoming producing area, Winkleman dome in Fremont County, added an 800-bbl. per day well last week.

The new addition to this 1917 field is Pan American Petroleum Corp. A-35 SA-Tribal in SE NW NW 19-2n-1w. Location is in the northwest part of the field.

Production at the new well is from the Tensleep-Pennsylvanian at 2,865 to 3,198 ft. A pay thickness of 264 ft. was reported at the well. The operator says the well is capable of 800 bbl. per day after making 204 bbl. in 6 hours on pump.

This Wind River basin field was opened in 1917 with production in the Lakota-Morrison zones. Drilling in later years tapped Phosphoria and Tensleep production. There are 22 wells in the field on pump.

Since field discovery more than 14,000,000 bbl. of oil have been uncovered. Operators at Winkelman Dome in addition to Pan American are Continental Oil Co., and Farmers Union Central Exchange.

Bad

DEVELOPMENT of new Desert Springs gas field in Sweetwater County, eastern Green River basin, Wyoming, received a jolt last week.

El Paso Natural Gas Co. 3 Unit, C NW SE 3-20n-98w, the third well in this Mesaverde and Lewis producing area, was abandoned at total depth 6,460 ft.

The dry hole is 2 miles southwest of the discovery well which made 7,700 M.c.f. of gas per day from the Mesaverde. El Paso confirmed the field with a new-pay discovery at 2 Unit in SE NW SE 22-21n-98w, with production from the Lewis at 12 M.M.c.f. per day. Both the Mesaverde and Lewis are Upper Cretaceous in age.

The Desert Springs discovery set off a stir of new interest in the eastern Green River (Red Desert basin) country.

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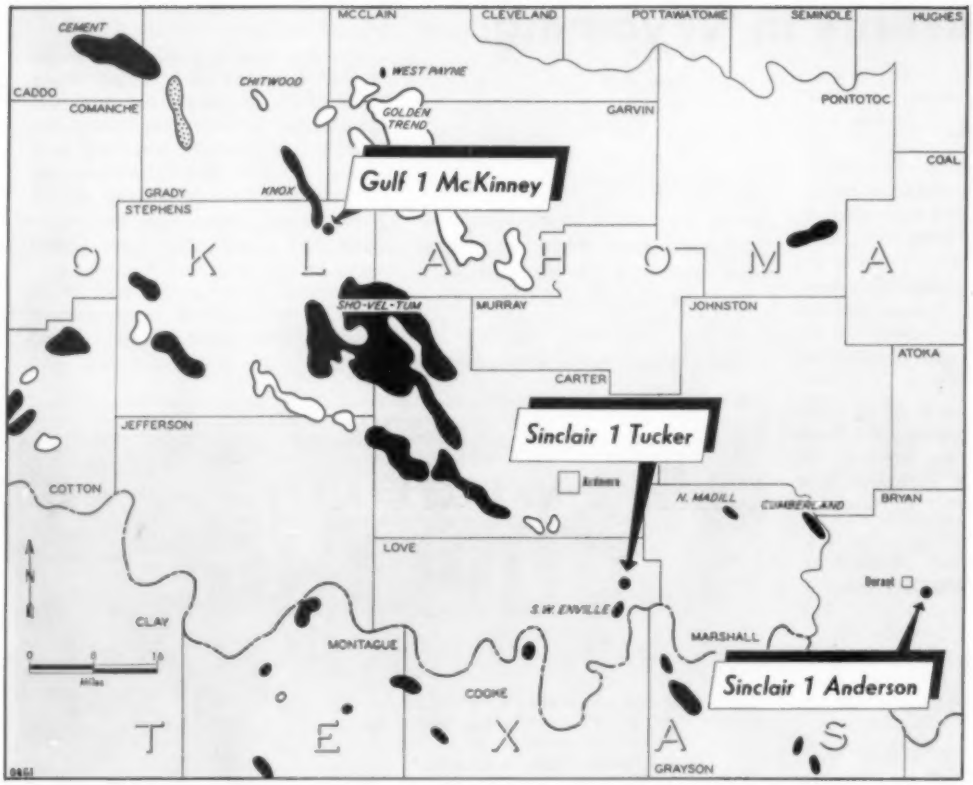
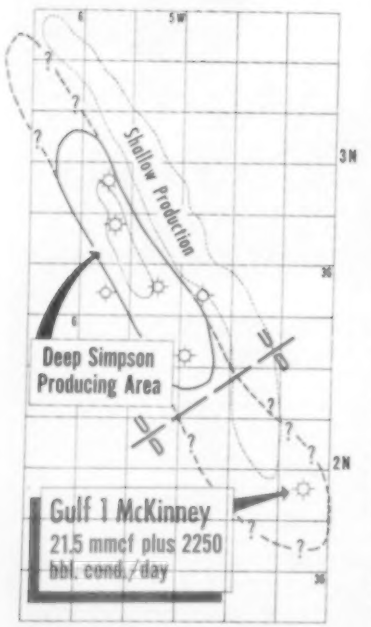


Fig. 1

In these southern Oklahoma counties . . .

Wildcatters turn to the Ordovician



CURRENTLY COMPLETED is this long southeast extension to the Carter-Knox play. Fig. 2.

SIMPSON pays, Bromide, McLish and Oil Creek sands, are pushing the Pennsylvanian sands well into the background. For many years following the discovery at East Velma, the primary exploration target in southern Oklahoma was the Springer sand.

But with the successful discoveries at Eola and Carter-Knox and more recently Southwest Enville, oil finders turned to the deeper Ordovician pays. Three successful wildcats are in various stages of completion and substantiate the wisdom of the change-over in exploration policy (Fig. 1).

- Gulf Oil Corp. is currently completing a long southeast extension to the Carter-Knox play. The 1 McKinney (SE SE NW 24-2n-5w) logged 120 ft. of Bromide sand above 15,800 ft. The well tested 21,500 M.c.f. of gas per day plus 2,250 bbl. of condensate (Fig. 2).
- Sinclair Oil & Gas Co. has opened up a new producing trend in Love County on the shores of Lake Texoma (Fig. 3). Sinclair 1 Tucker (NE NE SW 32-6s-3e) tested the basal Oil Creek sand for an estimated open flow potential of 10 M.M.c.f. of gas

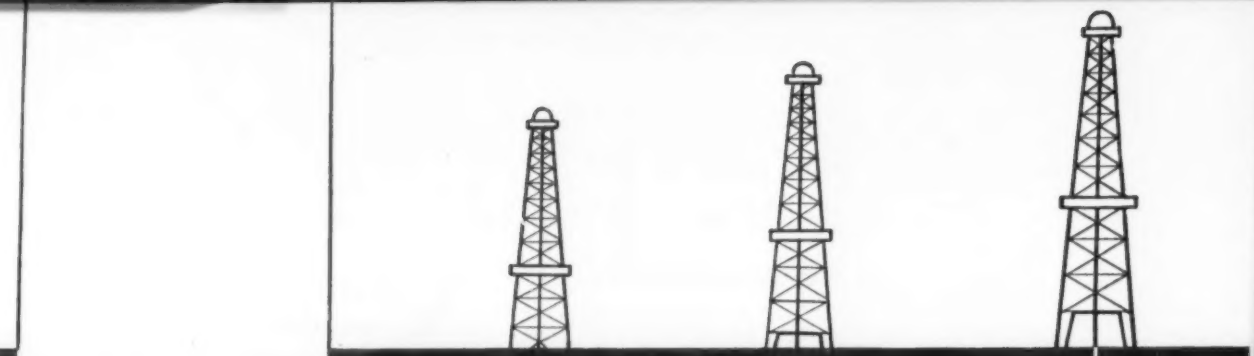
BY NORMAN S. MORRISEY
Drilling-Development Editor

per day plus 1,500 bbl. of condensate. Unconfirmed reports indicate approximately 100+ ft. of producing sand.

- Farther to the east in Bryan County, Sinclair has another apparent discovery near the town of Durant. The 1 Anderson tested 22°-gravity oil in the interval 8,253-8,305 ft. in the Oil Creek and in addition had indicated production in the Hunton, Viola, Bromide and McLish zones.

Carter-Knox play . . . Gulf's discovery could overshadow the initial Simpson production at Carter-Knox, the British-American 2 Harrison. The Harrison, completed in February 1956, was considered one of the most significant wells drilled that year in southern Oklahoma and cost approximately $800,000 to drill and complete. It had an open-flow potential of 31 M.M.c.f. per day plus 5,022 bbl. of condensate. In the first 16 months, the 2 Harrison produced approximately 408,000 bbl. of condensate.

The well paid for itself in less than



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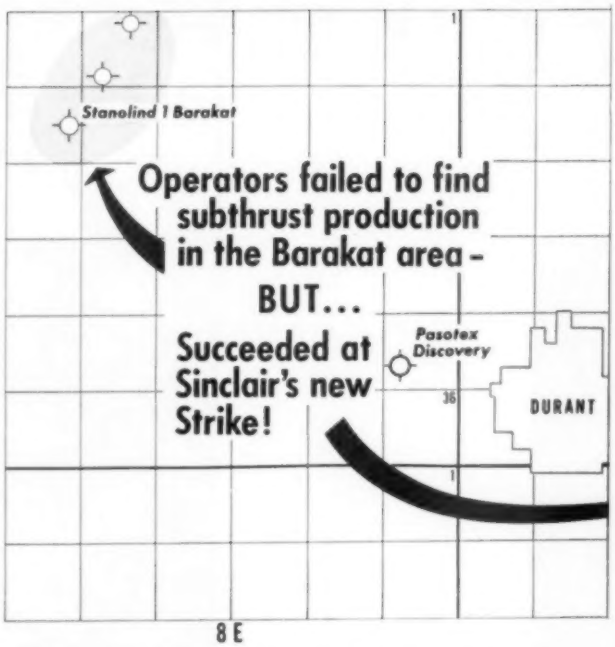
A NEW producing trend was opened up by 1 Sinclair Tucker. Fig. 3.



DISAPPOINTED at Barakat, operators hit near Durant.

1 year. Preliminary reports on the 1 McKinney suggest equally favorable economics. The spacing is 640 acres, and unconfirmed estimates are on the order of 5 million barrels per 640-acre unit plus 50 billion cubic feet of gas. Cost of the McKinney and other deep Simpson production along the Carter-Knox trend runs about $800,000 per well.

A preliminary seismic-geological map (OGJ, Mar. 4, 1957, p. 110) indi-

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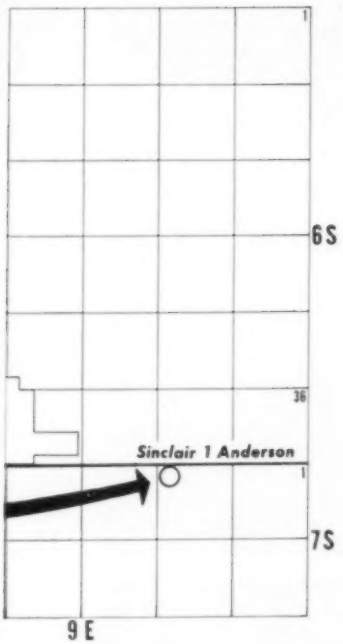

cates that the Carter-Knox play will be at least 15 miles long and that the trend is approximately 1½ to 2 miles wide. There is some evidence to indicate that the deep Simpson structure could extend several miles northeastward even into the Chitwood area. Undoubtedly the producing areas will not be continuous since faulting has been mapped and a recent Journal article (OGJ, Apr. 14, 1958, p. 166), indicates that the Gulf discovery is separated from the Harrison producing area by a fault.

Enville surprise . . . The Enville area in southeastern Love County has turned out to be a real surprise to many southern Oklahoma geologists because the Oil Creek sand is present and productive. The Texas Co. drilled the discovery at Southwest Enville approximately 2 miles south of the recent Sinclair discovery. The Texaco field is still under development and the exact structural interpretation is still in doubt. Quite probably Southwest Enville is a complexly faulted anticline or fault closure.

The Sinclair Tucker appears to be on a separate trend and it is exceptionally difficult to forecast at this time how big the discovery will be. Few, if any, wells within several miles of this strike along trend have penetrated the basal Oil Creek sand. The well is on the shore of Lake Texoma and quite probably the producing trend will extend both southeastward from the discovery and northwestward.

Most of the producing areas in this

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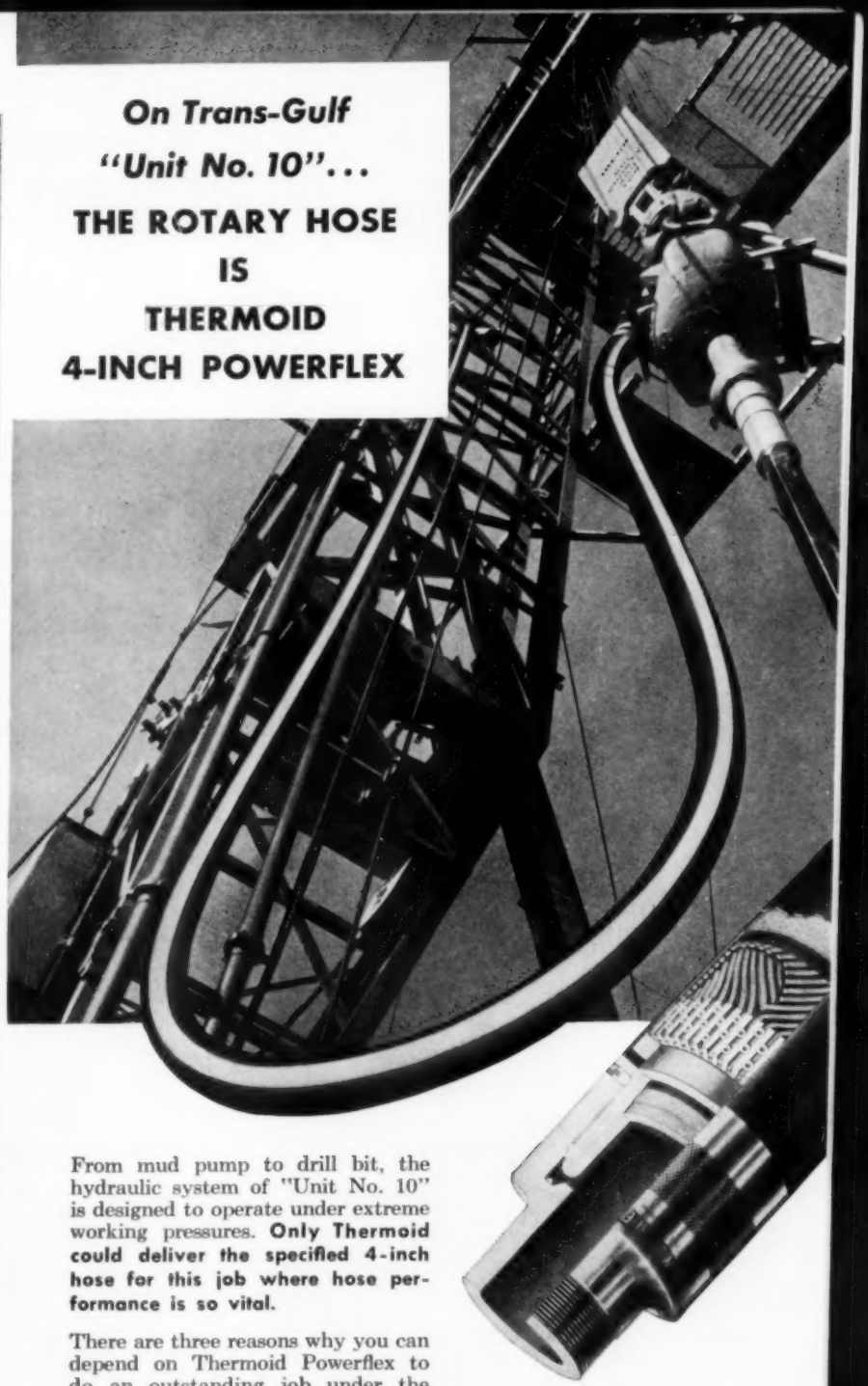

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part of southern Oklahoma are large, elongated, complexly faulted anticlines which can be traced for many miles in the subsurface. Southwest Enville is typical of what can be expected at the Sinclair strike.

Within the last year Pasotex drilled and completed a successful discovery 2 miles south of the Enville producing area. The result was a successful basal Oil Creek strike completed for 3.4 M.M.c.f. gas per day, and 57 bbl. of distillate per million. Undoubtedly this well is separated from the Southwest Enville field by a major fault.

These three new producing areas have completely altered many geologists' thinking on the oil possibilities of Love County. There was considerable doubt that there was any Oil Creek sand present in the area, but Southwest Enville plus the Pasotex discovery and now Sinclair's strike have completely torpedoed this line of thinking.

Gravity data (OGJ, Feb. 3, 1958, p. 142) reveal that several trends are regional in extent in the Marietta basin, and the trends extend from southern Oklahoma southeastward into Cook and Grayson counties, Texas, where the Oil Creek is also a prolific pay zone. Seismic work has been used successfully, particularly along the Texas trends, to delineate the producing areas. Undoubtedly these subsurface features of Texas will link up with the Overbrook-Criner Hills trends of Carter and Love counties.

Subthrust production at Durant . . . Oil finders held high hopes for oil production in Bryan County with the successful discovery of the Cumberland well in 1940. However, all efforts to extend Simpson production into Bryan County were quite discouraging until fairly recently. The Aylesworth trend was pushed southeastward into the extreme western portion of Bryan County.

The Barakat area in particular proved a bitter disappointment. Here in 6s-8e operators tried unsuccessfully to establish Simpson production beneath a major thrust fault. Seismic work in the Barakat area uncovered a promising lead and Ohio Oil Co. drilled a well that passed from Cretaceous at about 1,000 ft. into lower Ordovician rocks. The well was finally abandoned in the Arbuckle limestone.

Subsequently, Pan American Petroleum Corp. (then Stanolind Oil & Gas Co.) deepened the well and cut the thrust. Underneath the thrust fault the well penetrated a normal Simpson section and located several promising shows of oil. Efforts to complete the well as a commercial producer ended

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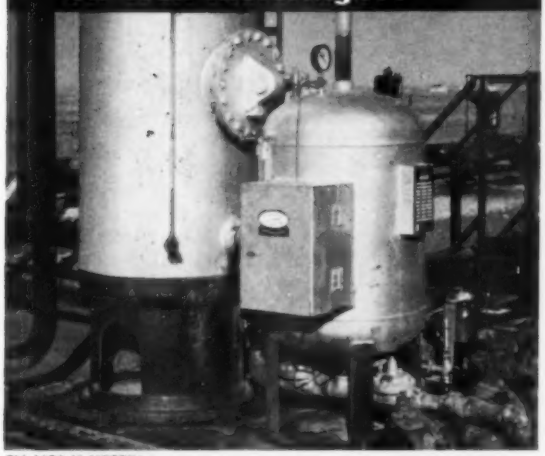

CV VOL-U-METER*

VOL-U-METERS®
are ECONOMY in action

Designed for simplicity, constructed for dependability, the VOL-U-METER provides continuous, accurate oil well liquid volume metering performance at the lowest operating cost. *Maintenance cost averages less than $5.00 per unit per year!*

Additional savings mount up in the use of the VOL-U-METER. For example, on an Oklahoma Lease one CV VOL-U-METER was used on a dual completion well and tied into a common tank eliminating the need for dual tankage on the dual well. The second welded tank, which would have been required, would have cost approximately $1,750.00, about *three times the actual cost of the VOL-U-METER.*

VOL-U-METERS are available in three types of vessels, the CV, FV and FVC (Type FV with cone-shaped bottom).

TYPE CV is barrel-shaped and utilizes one liquid level control pilot system.

Type FV features two liquid level control pilot systems with one in each of the reduced necks.

TYPE FVC features a cone-shaped metering chamber which is lined with plastic. It has a liquid level control pilot system in the upper reduced neck and one in the lower neck, as does the FV. The FVC is designed for use where foreign matter in well fluid will probably settle in the vessel reducing its metering accuracy.

The three types of VOL-U-METERS are available in dump volumes from ¼ barrel to 10 barrels, with capacities of 300 to 4,000 BPD, and working pressures from 125 psi to 1200 psi for the CV and to 2400 psi for the FV and FVC.

They can be equipped with either pneumatic or electric controls. Write for the latest literature on the accurate oil and water VOL-U-METERS.

(*PAT. APP. FOR)

Sales and service representatives in all major oil fields.

OIL METERING and Processing EQUIPMENT CORP.

MELROSE 5-1226 • 4843 YALE STREET
HOUSTON 18, TEXAS

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...*because* it was a better pipe wrench when first created 35 years ago, and has been improved nearly every year since . . . in performance, design, materials. Today, it is still the most for your money. Buy RIDGID at your Supply House.

The Ridge Tool Company, Elyria, Ohio, U.S.A.

Dependable

HERCULES STUFFING BOXES end Your pumping worries*

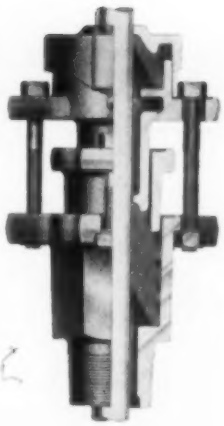
HERCULES Duplex Polished Rod Stuffing Boxes are constructed from high grade malleable iron (55,000 PSI Tensile Strength) and are rated 3,000 pound test. Flexibility and the cone-shaped Packing Rings are the combination of factors which make the HERCULES Stuffing Box without equal for any pumping situation.

HERCULES OIL RESERVOIR UPPER GLAND

**Any HERCULES Stuffing Boxes may be equipped with Oil Reservoir Upper Glands on "problem" wells which pump-off and burn packing. The polished rod moves through the oil in the reservoir which lubricates and cools it.*

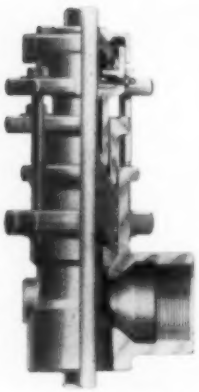
"REGULAR TYPE" DUPLEX POLISHED ROD STUFFING BOX

The old reliable; tried and proved on thousands of wells from coast to coast and in many foreign fields.



"TEE TYPE" DUPLEX POLISHED ROD STUFFING BOX

HERCULES "TEE TYPE" Stuffing Box is very compact, only 15" high. It is full opening which allows rods to be run or pulled without removing Stuffing Box body. It is furnished in 2", 2½" and 3" sizes with any API Tubing or Line Pipe Thread.



"TYPE DP" DUPLEX POLISHED ROD STUFFING BOX

A double packed Stuffing Box for use on high pressure wells and those that flow intermittently. Especially desirable for wells located near buildings, fire hazards or growing crops. Two compression bolts, in bottom sections, are tightened on lower packing set while replacing packing in upper section. Possess same flexibility as the regular and Tee base type.

HERCULES TOOL Company

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Export Representative: Oil Field Equipment Co., Inc., 30 Church Street, New York 7, N. Y.

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Have Long Life and are Self-Regulating

Unlike other metals sometimes used for cathodic protection, zinc anodes have an expected life of a minimum of fifteen years. Zinc anodes are self-regulating and require no current regulating resistors to meet the load demand, whether high or low.

These are important reasons why American Zinc Anodes are first choice for cathodic protection in the oil and gas industry. Your inquiries invited.

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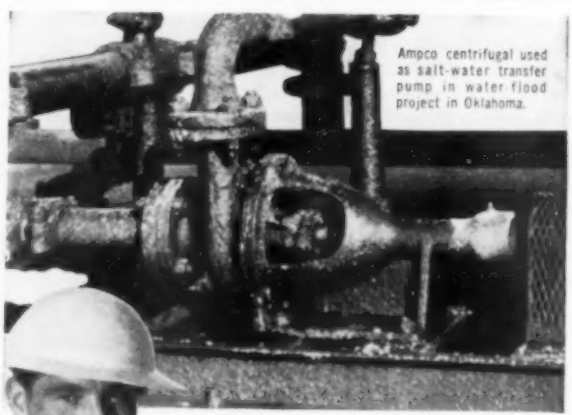


Ampco centrifugal used as salt-water transfer pump in water-flood project in Oklahoma.

An Ampco® Centrifugal Pump thrives on salt water!

Engineered to resist velocity, erosion and corrosion. Extra protective features—at no extra cost — reduce maintenance and downtime.

Available *from dealer's stock* in stainless steel, Ampco Metal, and Illium "G" — and with elastomer or rubber linings. See your Ampco Pump Distributor.

P-41

WRITE FOR BULLETIN P-3B

AMPCO®

AMPCO METAL, INC. DEPT. OGJ-5, MILWAUKEE 46, WIS.

WEST COAST PLANT: BURBANK, CAL. • SOUTHWEST PLANT: GARLAND (DALLAS CO.), TEX.

in failure, and it was finally abandoned as a dry hole. Later Pan American, with other operators, drilled two additional tests, both of which were abandoned as dry holes.

The Sinclair strike has a rather similar early exploration history, but apparently will end in success. The well was initially drilled and abandoned as a dry hole in Ordovician rocks. Recently, however, Sinclair reevaluated its holdings and decided to drill the well deeper. The well cut a major thrust fault and found several potential producing zones below the thrust. During drilling operations, the Hunton, Viola, Bromide, and McLish all appeared to be potentially productive. The Oil Creek yielded 20°-gravity oil on drill-stem test but apparently is noncommercial.

The significance of Sinclair's discovery can hardly be overemphasized. It pushes Simpson production 6 miles southeastward beneath the Cretaceous overlap.

In addition, the Sinclair well points up the importance once again of subthrust production in southern Oklahoma. This has long been recognized by many geologists but to date there are only a handful of fields producing from below a thrust fault. Sinclair's strike will undoubtedly help set the stage for more wildcats in this promising but complexly faulted and folded area of southern Oklahoma.

First Cotton Valley oil well completed

MISSISSIPPI'S first Cotton Valley oil well, its deepest producer, second-deepest hole will be dually completed.

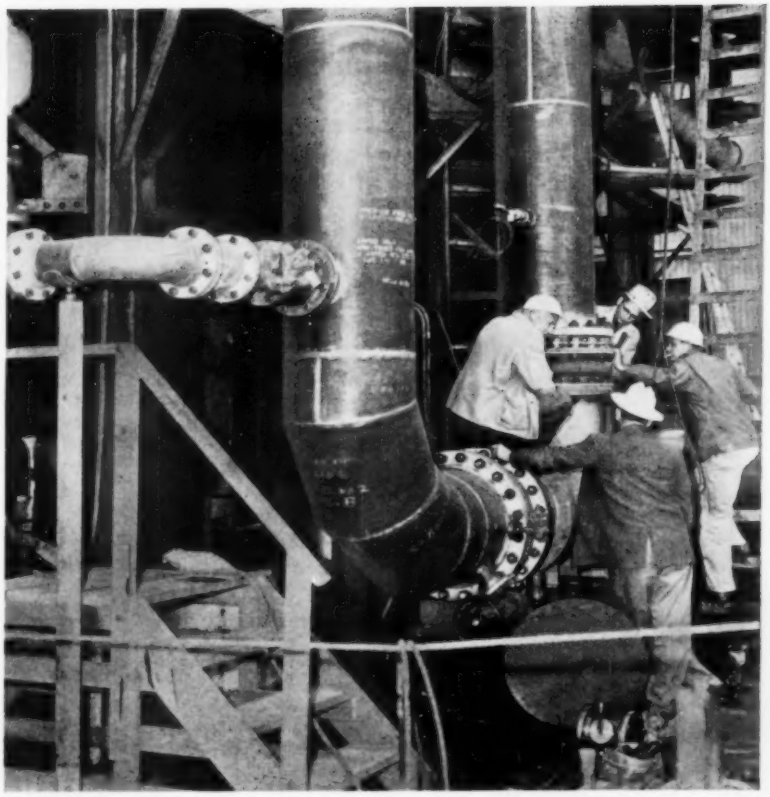
Gulf Oil Corp. is preparing for completion at its Soso field well, the 1 Z. B. Soso field unit in Jasper County. Completion will be made in both the Hosston nad the Cotton Valley.

A drill-stem test in the Hosston at 12,598-12,617 ft. flowed oil at the daily rate of 370 bbl., 40° gravity, on 10/64-in. choke. On test of the Cotton Valley at 15,247-56 ft. it flowed 190 bbl. of 37.6°-gravity oil per day.

Illinois action is at Mount Auburn

NO NEW POOLS were discovered in Illinois in April according to the Illinois Geological Survey, Division of the Department of Registration and Education.

There was one extension to each



Erecting piping at a potash refinery in Carlsbad, N. M., operated by Pacific Coast Borax and Potash Co. After nine months service, there is no sign of stress-cracking — yet pipe and fittings were not stress-relieved or heat-treated during fabrication.

Field-fabricated without stress-cracking!

Pipe and fittings are of NEW AMPCO METAL GRADE 8

Forget your old ideas about fabricating copper-base alloy equipment to handle steam and corrosive media at elevated temperatures. New — *entirely new*—Ampco Metal Grade 8 changes all that!

Now, for example, you can get pipe and fittings that

- ... can be field-assembled, without stress-relieving — yet won't stress-crack!
- ... provide many times greater protection against corrosion and erosion
- ... can be readily welded
- ... can be formed on standard equipment
- ... are too tough to be chewed or crushed by wrenches
- ... are available in all standard types and sizes — also specials.

At one major oil refinery, field-assembled piping of Ampco Metal Grade 8 has handled hot sulphuric-acid sludge for a year and a half without stress-cracking.

Sound promising? It is! Ask your Ampco field engineer about new, patented Ampco Metal Grade 8. Or write for details. *Ampco Metal, Inc., Dept. OGJ-5, Milwaukee 46, Wis. West Coast plant: Burbank, Calif. —Southwest plant: Garland (Dallas County), Texas.*

TS-3

AMPCO®

AMPCO

Guiberson's New *Rotating* J2 DRILLING HEAD

Now you can do well servicing and completion work better than ever with Guiberson's J2 Drilling Head that has a built-in, compact rotary table. Twenty-one new features have been built into this husky head. All designed for longer life..easier maintenance..faster, more profitable jobs for you.

USE IT FOR REVERSE OR CONVENTIONAL CIRCULATION. For your drilling or servicing work set-up the J2 head either way. Then circulation can be changed back-and-forth at will for faster, more economical cleanout.

USE IT FOR GAS OR AIR DRILLING. The new type wash pipe is designed for continuous drilling. An advantage you can use to complete jobs faster..more economically.

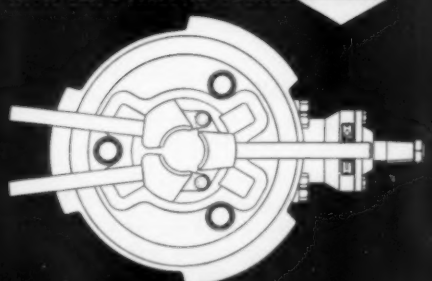
USE IT FOR SLIM-HOLE DRILLING. You'll like the unitized slips for one-man operation..more pipe holding strength..easier on your tubing. Plus the heat-treated kelly drive bushings for longer wear.

ADDITIONAL FEATURES. Heavy-duty spindle..retainer ring takes spindle load..wash pipe hardened *throughout*, not just case hardened..wash pipe packing replaceable in field..two lubricated dust seals protect bearings and gear..strong lifting eye hooks, cast integral with body..fast, easy rubber tightening with 3 studs..quick detaching top for easy rubber removal.

Sold by Oil Field Supply Stores Everywhere

TYPE J2 DRILLING HEAD WITH KELLY BUSHINGS IN PLACE

HEAD WITH SLIPS AROUND TUBING



THE GUIBERSON CORPORATION

ESTABLISHED 1919

DALLAS, TEXAS U. S. A.

of the following pools: Mount Auburn Consolidated in Christian County, Gila in Jasper County, and Clay City Consolidated in Wayne County.

A total of 137 wells were completed in April, a 4-week period, for an average of 34 per week. This compares with 25 per week in March. The 137 completions include 63 oil wells and 2 gas wells, or 47% successful.

Jasper County, with 20 wells completed, had the most completions during April. This was due to the development of Gila pool which was discovered in November 1937. According to survey records, there were 19 producing wells in Gila pool at the end of April.

Christian County, with 12 wells completed, was next to Jasper County in number of completions. This was due primarily to activity in Mount Auburn Consolidated pool where eight wells, including four producers, were completed in April. This pool was discovered in 1943, but until 1954 only five producing wells had been completed.

Estimated production for Illinois for April is 6,724,000 bbl. of oil.

Arkansas drillers miss in the east . . .

AN IMPORTANT wildcat in eastern Arkansas was reported as a dry hole last week.

It is Panhandle Eastern Pipeline Co.'s 1-22 Ives in Prairie County, 2 miles northeast of Ulm and 9 miles northeast of Stuttgart.

Total depth is 12,000 ft.

This wildcat was spudded over a year ago as a test for the nonproductive Desha basin.

but hit in the south

The discovery well of new Kilgore Lodge field in Columbia County, South Central Arkansas, was completed flowing 194 bbl. of oil per day, 46° gravity.

It is Arkansas Fuel Oil Corp. 1 B. F. Dennis in SE¼ 8-17s-21w, 2⅝ miles west of Magnolia. Production is from the Smackover at 8,092-96 ft.

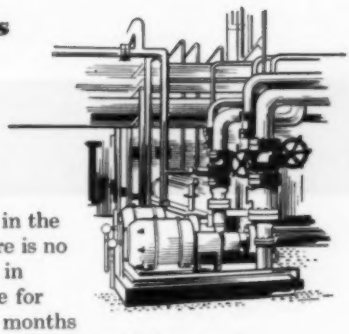
Gage is reported at the discovery well of new Champagnolle Landing field in Union County, South Central Arkansas.

John C. Robbins, Jr., and Jackson Oil Co. 2 W. E. Baker et al., NE SW 23-16s-14w, 9½ miles northeast of El Dorado, pumped 16 bbl. of 15°-gravity oil per day from the Graves sand at 2,652-56 ft.

Positive Proof...

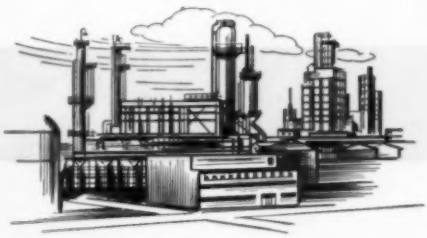
The John Crane® Type 9 Shaft Seal Solves Those Tough Liquid Handling Problems

Actual Field Reports



✓ from an Arkansas Refining Plant

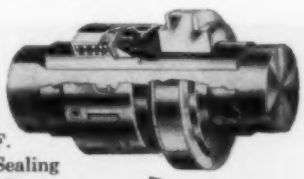
When it comes to avoiding trouble in the handling of naphtha at 420°F., there is no substitute for positive sealing. And in cases like this there is no substitute for "John Crane's" Type 9 Seal. Many months of completely satisfactory operation offers convincing proof.



✓ from a Louisiana Refinery

It takes a "lot of shaft seal" to handle a highly corrosive mixture such as an emulsion of sulphuric acid and butane. This stuff plays real havoc with metals due to its corrosive action. Despite this, Type 9 Seals on twenty seven pumps are pumping month after month in continuous service. At this same location, other Type 9's are effectively handling "fresh" sulphuric acid at the high suction pressure of 400 psi.

In cases like these . . . and in those confronting you . . . the surest answer is the "John Crane" Type 9 Seal.



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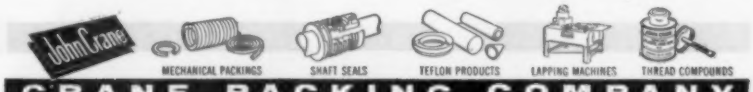
Recommended services: all industrial chemicals, corrosives, liquids or gases. Temperatures: –120°F. to +500°F. Pressures: up to 750 psi. Construction: Sealing members of chemically inert DuPont Teflon, metallurgy best suited to service requirements.

Send us your problems. Request Bulletin S-205-2.

Crane Packing Company, 6419 Oakton Street, Morton Grove, Illinois, (Chicago Suburb).
In Canada: Crane Packing Co., Ltd., Hamilton, Ont.



CRANE PACKING COMPANY

California: New finds in old territory

TWO NEW POOL FINDS in established areas of production point up the continued success of California operators in finding new reserves in the midst of proven fields.

Pacing this latest success are new pool discoveries by Reserve Oil & Gas Co. in the prolific North Tejon field and Kern Oil Co., Ltd., in the Mountain View field. Both are in Kern County on the south edge of the San Joaquin Valley producing province.

Reserve's newest find at North Tejon adds to the growing luster of this newly opened deeper-producing area. The latest discovery, Reserve 361-19 "W-T," was being cleaned out to total depth of 14,488 ft. prior to running water shutoff tests. It is located ½ mile south of the field discovery well.

At its present depth it is probably in the Eocene where tests will be made on prospective deep zones. The well is already an assured discovery success having tested a shallower interval at 12,015-12,174 ft. for more than 200 bbl. daily of 32°-gravity crude from a Vedder pool. This productive Vedder zone pool is different from the Vedder zone sands now producing in the field's three other wells comprising Reserve's area of activity.

Reserve's two Vedder pools, the discovery pool and the latest one recounted above, are still different from Richfield Oil Corp.'s recent North Tejon field new pool find some 1½ miles to the west.

A present count shows, in addition to its deep test now being cleaned out, Reserve was drilling ahead on an offset to the North Tejon discovery well and an offset to Richfield's new pool-discovery well 1½ miles to the west. Richfield was drilling an extension to its find two locations west and an offset two locations south.

Mountain View discovery — Kern Oil Co. of California, Ltd., was being credited with a new pool discovery on the north edge of the field. Kern's test, 46 Winters, recovered 4,860 ft. rise of 32°-gravity crude on a 2-hour, 20-minute test of a formation just above 6,981 ft.

Nearest production is about ¼ mile south in 13-30s-28e.

Gosford area active . . . Operators were continuing their efforts to prove up additional acreage in the recently touched off East Gosford field in Kern County.

A rundown shows these projects under way:

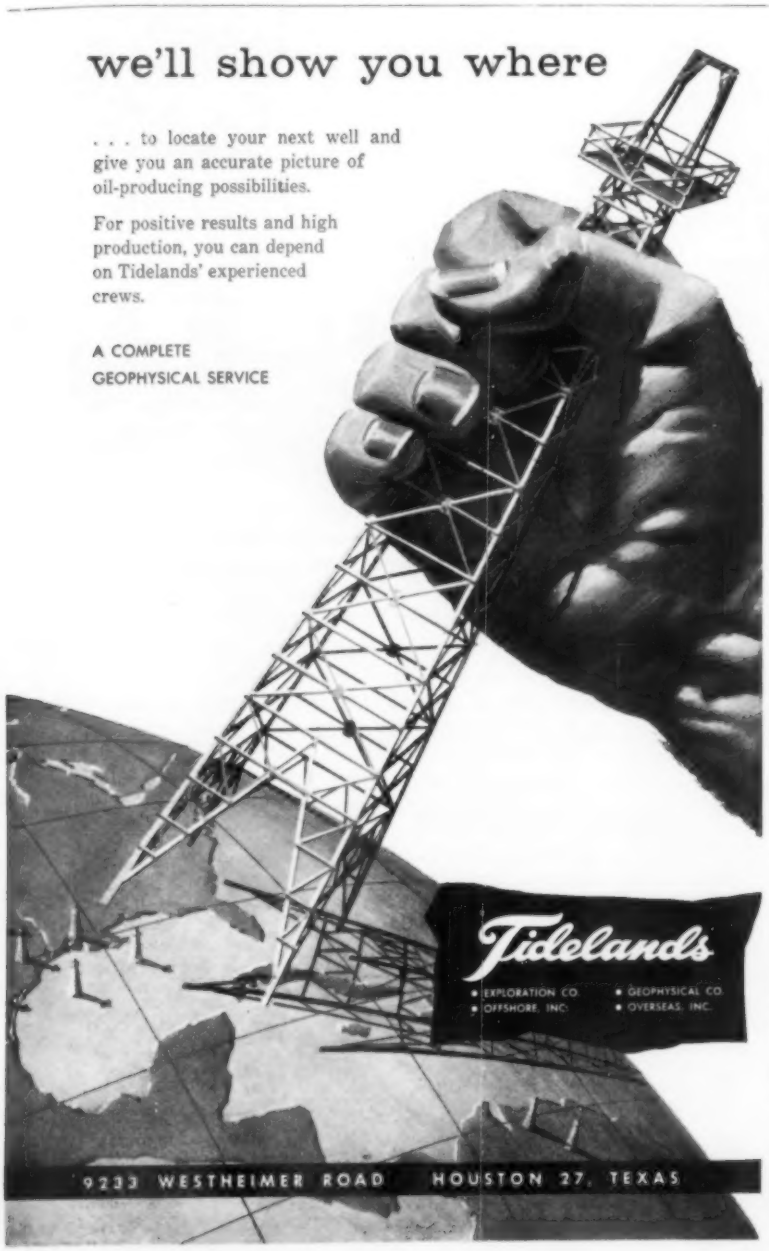
. . . Getty Oil Co. was drilling below 4,877 ft. on 75X Campbell on the south flank of the activity.

. . . Shell Oil Co. was drilling below 10,817 ft. on a test about 3 miles southeast of the area.

. . . Union Oil Co. was testing a 10,320-ft. extension effort about ¼ mile northwest of the discovery area. Another site for a Union wildcat was being graded about 1¼ miles west of the discovery area.

. . . Universal Consolidated Oil Co. was drilling below 4,425 ft. on an offset to the discovery.

California highlights . . . Atlantic Oil Co. completed a 5,550-ft. extension test in the old Bardsdale field in Ventura County flowing 347 bbl. daily of 38°-gravity crude through a 20/64-in. choke. This well is on the northeast edge of the field . . . Davidor & Davidor, operators, were test-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Competition is the key to success in all phases of the oil industry. Large, medium and small oil companies compete to supply the products that fuel our nation's economy.

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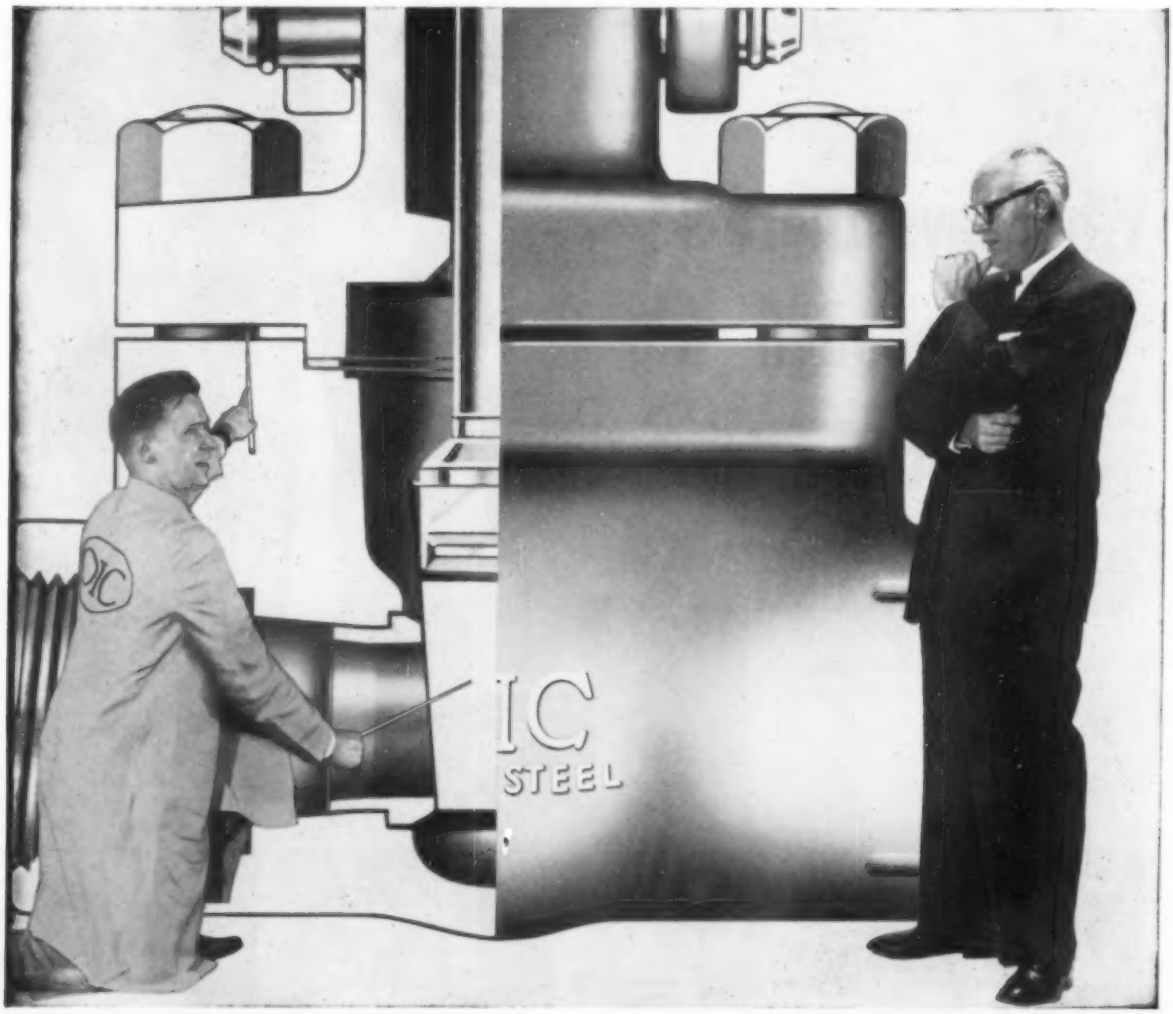
...and you can see here....and here, sir,
how we've killed maintenance problems
on our new forged steel lines.



We stop galling and erosion by giving you 13% chrome stainless steel trim with wedges *duracased* to a rugged *1000 Brinell hardness.*

The square and *bolted* body-bonnet joint makes it easy to service the valve quicker. And it's a tighter joint, made doubly leakproof by recessing the soft iron gasket into the body. The gasket can't blow!

And you get the fastest joint make-up you've ever seen. Look at those pipe ends. See the extra wrench-gripping area and lugs. See how body-bonnet flanges are out of the wrench's way. No time lost here!

These new 600-lb. OIC forged steel valves are available with either *high-flow* ports (1300 line), or *standard-flow* ports (1100 line). Call your OIC Distributor, or write for specification literature.

The Ohio Injector Company • Wadsworth, Ohio

OIC VALVES | BRONZE, IRON, FORGED AND CAST STEEL, LUBRICATED PLUG VALVES

ing a 6,105-ft. extension test about midway between the Willows and Beehive Bend gas fields in Glenn County in northern California . . . Geochemical Surveys will drill a 12,500-ft. test in the southerly part of Section 17-28s-25e, in the Shafter area of Kern County. This is in the region where Superior Oil Co. drilled and abandoned a 15,000-ft. test in 1954, and Tidewater Oil Co. drilled a 12,500-ft. dry hole 1 mile to the west, also in 1954.

In Gulf of Mexico, new strike gets gas-distillate pay

NEW gas-distillate production in the Gulf of Mexico off South Louisiana was announced last week.

Union Oil Co. of California found a new gas-distillate reservoir in Block 67 of the West Cameron area, offshore from Cameron Parish. The discovery flowed 107 bbl. of distillate per day plus 5,325 M.c.f. of gas per day on 16/64-in. choke from perforations at 11,345-55 ft.

New pay strike . . . Kerr-McGee Oil Industries, Inc., found a new pay sand in Block 28, Ship Shoal area. The well flowed 9 M.M.c.f. of gas per day and 732 bbl. of distillate from perforations at 14,196-14,230 ft.

Other events . . . Other offshore happenings included a state potential gage at Magnolia Petroleum Co.'s A-1 OCS-089 (State Lease 1202) Block 64 East Cameron wildcat. This well has been shut in for almost a year. Potential gage on 11/64-in. choke was 2,949 M.c.f. of gas per day and 75 bbl. of distillate from 10,294-10,306 ft.; the flow at 9,804-16 ft. was 3,452 M.c.f. per day and 98 bbl. of distillate on 13/64-in. choke.

New Gas Distillate Found In South Louisiana

The Mystic Bayou area of St. Martin Parish, South Louisiana, has new gas distillate production. Drilling & Exploration Co., Inc., et al completed the 1 Williams, Inc., at total depth of 13,007 ft.

The well was completed through perforations in 5½-in. casing from 12,478-86 ft. On potential tests it flowed 3,225 M.c.f. of gas daily on 12/64-in. choke with a distillate yield of 24 bbl. per 1 M.c.f. of gas. Location is NW¼ 9-13s-11e.

Note rugged branch construction on this massive oil header fabricated with a length of pipe and five 30 x 12 and two 30 x 30 weldolets.

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Closer manifolding, ease and speed of field fabrication without header distortion, lower purchase and welding costs are just a few of the profit benefits of header fabrication with Bonney Weldolets. Today there is particular need for reducing costs. Bonney Forge can provide this opportunity for cutting costs in your company. Write, phone or wire for details.

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N. W. Oklahoma has hit in Harper . . .

A 1957 DISCOVERY AREA that was abandoned after a few months in Harper County's northeastern sector, northwestern Oklahoma, has been revived. Hamilton Brothers' Ltd., completed an Oswego-Pennsylvanian gas well at North Lovedale to reopen the area to further possible development.

The 1-1 Dies, C SW NE 127n-21w, flowed 2,318 M.c.f. of gas per day from perforations at 5,434-44 ft. Testing on 1-in. choke got 20 bbl. of new oil hourly for 7 hours and 1,074 M.c.f. of gas along with the oil. On 24/64-in. choke flow was 10 bbl. of oil hourly and 1,250 M.c.f. per day. The final flow on this choke was 113 bbl. of oil, 44.3° gravity, in 12 hours and 1,355 M.c.f. of gas per day.

This field was opened as a Viola producer early in 1957, causing considerable interest because of its pay zone and its far-removed location from any production, Viola or otherwise.

and in Major County

WESTERN Major County's Northeast Cheyenne Valley pool, northwestern Oklahoma, got its second producer.

Gulf Oil Corp. 1 Sodowsky, C SE SE 32-22n-14w, flowed 120 bbl. of oil in 6 hours on 15/64-choke and 340 M.c.f. of gas per day from the Cherokee - Pennsylvanian sand at 6,890½-6,924 ft.

Another well, the 1 Retta, C NW NW 4-21n-14w, has been staked by Gulf.

Dakota delivers in San Juan basin

FIRST DAKOTA production was added to the Gallup Gallegos trend between Bisti and Blanco fields in the San Juan basin of northwestern New Mexico.

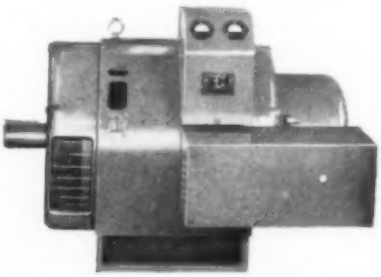
Pan American Petroleum Corp. 1 Randel, SE NW SW 9-26n-11w, flowed 5,496 M.c.f. of gas daily from Dakota Cretaceous perforations at 6,189-6,280 ft.; from the Gallup at 5,300-5,458 ft. the well made 131 bbl. of oil daily.

The nearest Dakota production to Pan American's strike is 4 miles southeast at a Skelly Oil Co. discovery, the 1 Davis. That well made 1,900 M.c.f. of gas per day from the Dakota and 1,400 M.c.f. per day from the Gallup. The Gallup is also Cretaceous.

Get the latest!

A COMPLETELY NEW "PACKAGED" GENERATOR

AMP-PAK



AMP-PAK Generator shown is rated at 187 kva, 1200 rpm, 240/480 volts. AMP-PAK is available in ratings of 75 thru 187 kva at 1800 rpm and 62½ thru 187 kva at 1200 rpm. Three phase, 80% PF, 60 cycles, 50C rise, and 120/208, 240 and 480 volts.

No exciter . . . No moving parts in the voltage regulator

AMP-PAK is a compact, revolving field a-c generator with built-in, static excitation system; static voltage regulator; and basic metering and controls conveniently grouped. AMP-PAK is a portable unit, factory assembled, internally connected, and tested.

No rotating exciter to maintain. D-C excitation is provided by a heavy duty, long-life, static rectifier.

No tubes, relays, vibrators to service. Voltage is regulated by a static, E-M-developed sensing circuit and "magical" magnetic amplifiers.

Holds voltage "rock-steady" so your motors, lights, and electronic equipment will work better. The static regulator provides ±2% regulation.

Starts big motors. A special, built-in voltage booster transformer stands by to reinforce line voltage when heavy loads are suddenly applied.

Easy to install. Needs no switchboard. Just connect load to AMP-PAK thru a suitable line switch.

Simple to operate. Has no belts, no "tricky" commutator, no adjustments—anyone can operate AMP-PAK.

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E-M

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Minneapolis 13, Minnesota

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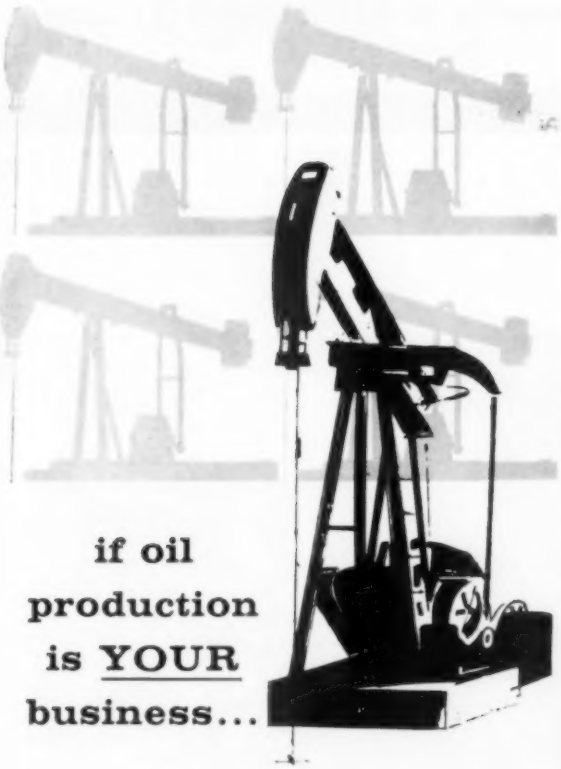

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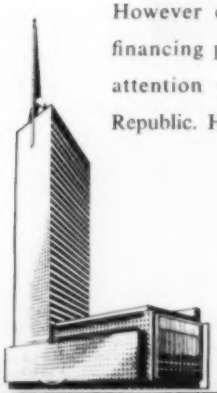

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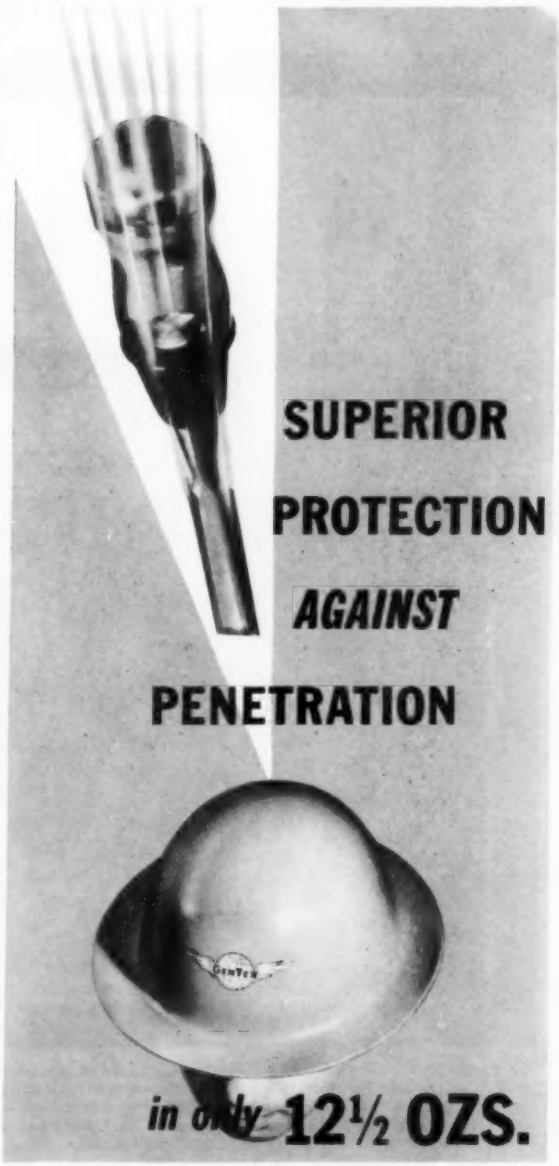

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Every form of transportation . . . wagons, automobiles, aircraft . . . has been used in the past 100 years by the supply store industry to get routine or emergency equipment where and when oil operators needed it. The supply man has pioneered right along with the wildcatter, dedicated to his industry's needs and growth.

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For nearly a hundred years, the search for oil has steadily increased. The pattern has not differed . . . only the size of the effort.

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Then stores and men stay behind to supply development. But others hike off to the next area of activity.

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To keep the large numbers of wildcatting and development rigs supplied properly is a giant task. It always has been. It always will be.

But PESA supply members have done a good job, recognized by the industry they serve as having had a major part in the success of the industry.

How much more would it cost manufacturers and oil operators alike to do business without them?

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57-105

PROUD TO BE PART OF A PIONEERING INDUSTRY

Ohio's Ironspot expands north . . .

Ironspot pool in Newton Township, Muskingum County, continues its expansion.

An extension of ¼ mile to the north, completed by Smith Petroleum Co. on 1 John Spring, Section 27, gaged 2,620 M.c.f. after fracture, from Clinton sand at 3,496-3,531 ft., while National Gas Co. moved west ⅓ mile for their 1 M. M. Bell, Section 34.

The gage was 525 M.c.f. before fracture with the sand being logged at 3,475-3,516 ft. Six rigs are currently working in the pool.

And Layland steps west

A stepout 2,000 ft. west of Layland Extension pool flowed 90 bbl. with 300 M.c.f. of gas in a 24-hour test after fracture.

The operator, William Patton et al., reported the test on 1 The Blue Crystal Mines, Inc., Section 3, Monroe Township, Coshocton County, as making a fair showing natural in Clinton sand logged at 3,470-3,528 ft.

Deep reach gets gas in Canada

BERLAND RIVER in northwestern Alberta is Canada's deepest producing area.

Two weeks ago Shell Oil Co. and British American Oil Co. found gas in the Devonian D3 reef below the 12,000-ft. mark. High flow rates were reported on three separate drill-stem tests.

The operators ran into circulation troubles after finding 213 ft. of effective pay in the D3 reef. The troubles have been overcome and testing and coring operations will be resumed shortly. The operators plan to take the well to the Slave Point-Devonian —the big oil zone at Kaybob 30 miles northeast, and at Swan Hills.

The Berland River discovery flowed 27 M.M.c.f. of gas on tests—the highest flow of gas recorded in the D3 in Canada. The 12,000-ft. producing mark breaks the previous record set just a few weeks ago at Willow Creek, 60 miles south of Calgary in the Foothills belt. That well flowed oil at 10,676 ft. in the Dalhousie zone of basal Blairmore-Cretaceous.

Last week Pan American Petroleum Corp. came up with another discovery in the Berland River area at 10-10 Berland River, 11 miles southwest of

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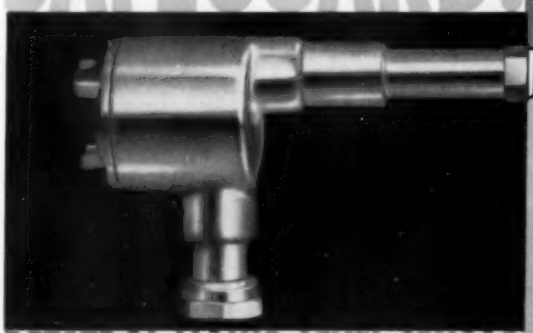


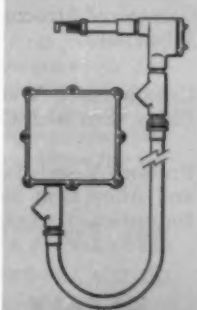
BETATROL LIQUID LEVEL SENSOR

BETATROL is a density-sensing device utilizing the absorptive characteristics of liquids when subjected to radioactive emission. A permanently sealed source of beta radiation and a beta ray detector tube are mounted in the probe, separated by a space open to the liquid. When the level of liquid is below the probe position, beta particles emitted from the radioactive source pass with minimum of absorption to the detector tube and the integral relay is not actuated. When the probe position is encountered by the liquid, beta radiation is absorbed by the liquid and a positive signal actuates the relay to start motors, pumps, valves, warnings or other devices.

BETATROL—Robertshaw-Fulton's new Liquid Level Sensor, provides fail-safe assurance against false readings and false operation of automatic custody transfer equipment. Complimenting the use of gamma radiation for well-logging purposes, BETATROL employs *beta* radiation to provide the benefits of nuclear research for more reliable and accurate oilfield instrumentation.

BETATROL maintains *constant* fixed position monitoring of the presence or absence of crude at predetermined tank levels, allowing unattended high-low tank level control. The unit contains no moving parts, assuring years of satisfactory watchdog service. Constancy of the sealed radioactive beta source is realized by virtue of its 28 year half life. Explosion-proof installation is simple and no adjustment is necessary. Probes and amplifiers can be interchanged as desired. Safety-limiting features are of positive action to prevent tank rupture or other negative consequences.

Advise today the particulars of your installation for prompt receipt of full information. Write for Bulletin R-F 58-1.



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the Shell et al. discovery well. This one got gas in the D1 zone. Gas flow was about 1 M.M.c.f. per day before mechanical troubles arose.

Full potential is not known as yet. Finding gas in the D1 at this well is significant because at Beaver Creek, 30 miles east, production is from this zone at almost the same elevation as Pan American's well. Logging operations are now under way. The well will be taken down to the D3 for testing at about 13,000 ft.

Subsidence of Wilmington Oil Field, California

BY U. S. GRANT IV
UCLA

THE WILMINGTON oil field, Long Beach, Calif., has been producing oil and its surface has been subsiding for two decades. The point of maximum subsidence has now lowered 24 ft., necessitating costly dikes and fills. Bending of the overburden has produced centripetal horizontal displacements of surface points, some over 6 ft.

Outside a central area of compression is a marginal zone of tension. These horizontal displacements of the surface have caused considerable damage.

The bending of the overburden above the Terminal zone, the greatest oil-producing interval and the one that has compacted the most, has produced subsurface shear stresses that have caused periodic ruptures along horizontal shear surfaces that have damaged or destroyed many wells, and caused local earthquakes.

The kinematics of these displacements are similar to the deflections in a horizontal plate deformed by a central point load. The analogy to an elastically isotropic elliptical plate of considerable thickness, clamped at the margin and deformed by a uniformly distributed lateral load, was a close one during the early history of the subsidence. At present stresses are so great that departures from isotropy and perfect ellipticity in the subsiding oil field make the simple plate model less satisfactory.

The mechanism of subsidence appears to be (1) elasticoplastic compression of the oil sands due to drop in reservoir pressure, (2) compaction of siltstones adjacent to oil sands due to decrease in interstitial fluid pressure, and (3) consolidation of some shales by loss of pore water to more permeable beds in which fluid pressure has been reduced. These last two processes apparently account for the great increase in water cut, now nearly

50%. A study of time lags of changes in subsidence rate with changes in production rate (about 8 months to over 2 years) suggests siltstone compaction is the chief contributor to surface subsidence at the present time.

The gradually decreasing rate of subsidence of a bench mark near the center of subsidence seems to follow the differential equation of natural decay. Integrating this equation for 12 years into the future gives a maximum subsidence of 32 ft. in 1970.

If the Wilmington field could be effectively repressured as a unit operation much of the future subsidence could be avoided.

This is an abstract of an AAPG paper presented in Los Angeles, March 1958.

It's official: oil in Colorado's Baca

FIRST OIL PRODUCTION was officially opened in Colorado's Baca County in the extreme southeast corner of the state, just north of the Oklahoma line.

Shell Oil Co. 1 Federal Land Bank, C SE NE 31-34s-44w, pumped 19 bbl. of oil and 129 bbl. of water per day and flowed gas at the rate of 916 M.c.f. per day from Des Moines-Pennsylvanian at 4,113-18 ft.

This well is the county's first oil producer. Location is 20 miles west of Greenwood gas field, a Kansas Pennsylvanian producer which lops over into Colorado. Shell also completed a gas discovery at 1 Copenhaver, just south of the oil strike in C NE NW 6-35s-44w. This strike, also a Des Moines producer, flowed 2,200 M.c.f. per day.

The Scale in Exploration

Michigan Has Mixed Success in Hillsdale . . .

A HALF-MILE northwest extension of Scipio field, Hillsdale County, appeared assured with A. E. Rovsek 1 Wood NW SE SW 3-5s-3w, showing gas and oil in the upper Trenton dolomite section.

The well logged Trenton at 3,576 ft. and had pay section at 3,775-80 ft. where 5-in. casing string has been cemented for completion with spudder.

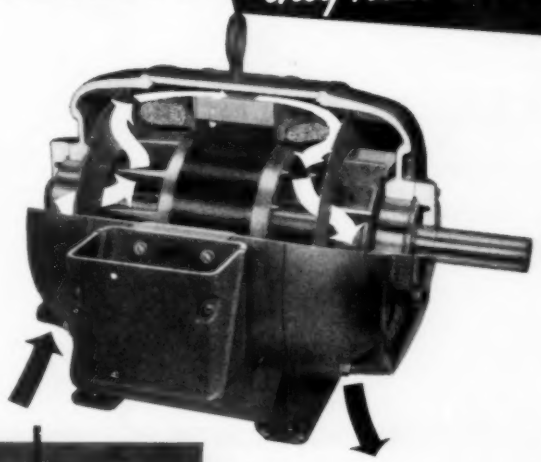
The Rovsek well is located one-half mile from the nearest producer and would mark the first extension of the pool north. As now developed, the 10 producing wells in the field extend an even mile on a southeast strike with 3 wells on 20-acre diagonal units, the widest area established.

And Newaygo County . . .

Prospects for the new Barton play, Newaygo County, were dulled when John Cutter 1 State NW NW SW 15-16n-11w, southeast diagonal offset to the Traverse discovery, drilled zone dry at 3,164 ft.

Discovery is producing 26 bbl. day on pump, down from 54 bbl. on completion earlier in the year.

Grease lasts 52% longer because- they run cooler!



NEW R&M "All Weather 40" OIL COUNTRY MOTORS

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Successful Wildcats

ALBERTA

Union 12-30-87-7 Red Earth Creek, LSD 12, 30-87-7w5. Granite Wash oil well. TD 5,030 ft.

Shell 2 Waterton Park, LSD 7, 2-4-1w5. Mississippian gas well. TD 12,765 ft.

SOUTH LOUISIANA

Jefferson Davis Parish: San Jacinto Oil & Gas Co. 2 La Rice Milling Co., 41-9s-3w, North Jennings field. IPF 132 BOPD, 10,094-10,102 ft. TD 11,510 ft. New pay. Dually completed. 165 BOPD, 10,599-10,600 ft., 10,484-85 ft., 10,293-94 ft., 10,200-30 ft., 10,110-11 ft., 10,065-66 ft., 9,643-44 ft.

CALIFORNIA

Contra Costa County: McCulloch Oil Exploration Co. of California, Inc., 1 McCulloch-Macson-Ginochio, NW NE 18-2n-1w, 2,300 M.c.f. daily, 24/64-in. choke, perfs. 1,872-1,908 ft., TD 3,021 ft. (New gas field discovery 7 miles south of Suisun gas field.)

NEBRASKA

Kimball County: Tom Vessels, Jr. 1 Berkhoff, C NW NW 12-15n-55w. IP 140 BOPD, "J" sand 6,102-08 ft. TD 6,210 ft. Opens Berkhoff pool.

WEST TEXAS

Garza County: Shell Oil Co. 1 J. B. Slaughter "D," 11 miles south of Post, Sec. 13, Blk. 1, J. Hays Sur. IPF 225 BOPD, 10/64-in. choke, 37°. Pennsylvanian 7,968-74 ft., 7,992-99 ft., 8,050-60 ft. TD 8,810 ft. New oil discovery.

Reagan County: Charles W. Shelton et al 1 J. R. Scott, 5 miles northeast of Big Lake, Sec. 179, Blk. 1, T&P Sur. IPP 10 BOPD, 36°, Grayburg 2,400-2,553 ft. TD 2,615 ft. New oil discovery.

Val Verde County: H. R. Rehders 1-A J. O. Taylor, 9 miles north of Juno, Sec. 70, Blk. E, GC&SF Sur. IPP 3 BOPD, 18.6°. Paluxy 360-65 ft., 370-84 ft., 398-417 ft. TD 455 ft. New oil discovery.

TEXAS GULF COAST

Orange County: Orange, W. V. Bowles & Co. 9 M. Granger et al, 1 mile southeast of Orangefield, William Dyson Sur. A-10. IPF 92 BOPD, 10/64-in. choke, GOR 328:1. 25.4°. Miocene 4,072-77 ft. TD 5,048 ft. New oil pay.

NORTH TEXAS

Montague County: Eureka Oil Co. 1 M. C. Lerner, 6 miles west of Nocona, Blk. 45, Belcher Subd., William Ainsworth Sur. A-1. IPF 126 BOPD, ¼-in. choke, 42°. first conglomerate 5,228-40 ft. TD 5,332 ft. New pay discovery.

Parker County: Toto Gas Co. 1 Darnell, 8½ miles north of Weatherford, Sec. 173, TE&P Sur. IP 2,000 M.c.f. of gas per day, 2,830-45 ft. TD 5,017 ft. New gas discovery.

Wilson Exploration Co. 1 Poolville Unit 5, 1 mile south of Poolville, N. Harris Sur. A-1770. IP 2,250 M.c.f. of gas per day, open flow and 8½ BOPD, 48°. Strawn 2,413-23 and 2,429-36 ft. TD 4,267 ft. New gas discovery.

1 Poolville 7, Menan Mills Sur. A-932. IP 23,000 M.c.f. of gas per day and 216 BDPD, 5,095-5,109 ft. TD 5,600 ft. New gas-distillate discovery.

Wise County: Southern Union Gas Co. 1 Phillips Unit, Samuel Issacs Sur. A-454. IP 8,600 M.c.f. of gas per day, Bend congl. 5,538-6,049 ft. New gas discovery. TD 6,100 ft.

Young County: Anderson Petroleum Co. 1 M. W. Lowrance, 4½ miles southeast of Loving, Sec. 2719, TE&L Sur. A-1151. IPF 101 BOPD, ¼-in. choke, 42°. lower Bryson 3,697-3,704 ft. TD 5,404 ft. New oil discovery.

TEXAS PANHANDLE

Ochiltree County: United Producing Co. Inc. 1 J. L. Dodson, 9 miles south of Waka, 134-Blk. 4-T, T&NO Sur. IPF 651 BOPD, 24/64-in. choke, 40°. Cleveland-Penn. 6,395-6,411 ft. TD 6,458 ft. New oil discovery.

SASKATCHEWAN

Canpet et al 1-9 North Willmar, LSD 1, 9-7-4w2. Mission Canyon oil well. TD 4,233 ft.

UTAH

San Juan County, Superior Oil Co. 3 Navajo, 24-41s-24e. IPF 402 BOPD, 40.1°. Paradox 5,338-5,480 ft. TD 5,522 ft.

WYOMING

Sweetwater County: El Paso 1 Unit, 26-21n-98w. IP 7,700 M.c.f. of gas per day, Mesaverde 5,887-95 ft., 5,901-20 ft., 5,932-54 ft. TD 6,510 ft. Opens Desert Springs field.

MONTANA

Carbon County: Carter-Mobil 1 Wheatley-Government, C Lot 1 7-9s-22e. IP 1,100 M.c.f. of gas per day, 196 BCPD, 62°. Fuson 9,843-63 ft. TD 12,185 ft. New pay for Rockies and new field discovery.

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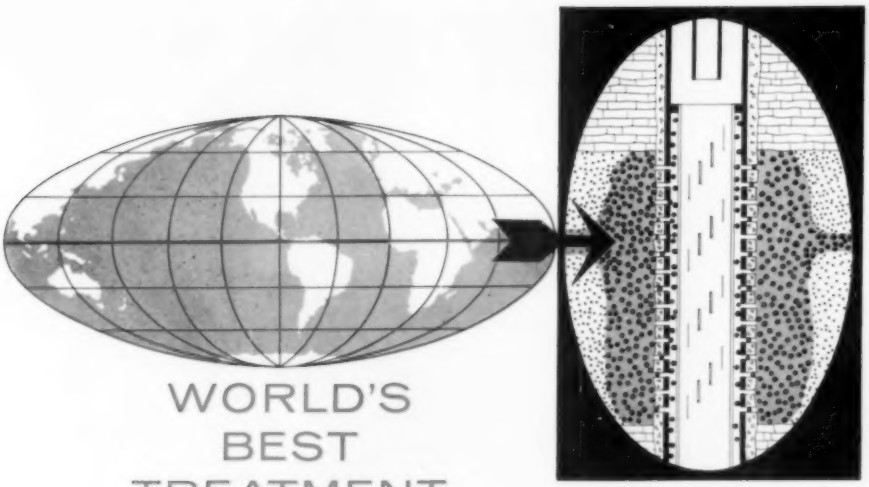

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For Unconsolidated Sands!

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Case histories prove the successful application of FRACPAC in hundreds of wells in a wide variety of formations. Halliburton's FRACPAC Technique has not only helped to provide unequalled control of unconsolidated or migrating sands, but also has frequently effected increases in overall net production.

In one producing field, for example, more than 40 wells were treated with economic FRACPAC. In every well, sand was successfully controlled and production was substantially increased. As a result, this producer is instituting a complete FRACPAC program for every well in the field.

In another case, 17 wells in another producing area were treated by Halliburton's FRACPAC. Sand control was effective, and the gain in total production attributable to this technique was estimated at more than 70,000 barrels!

For details of these and other case histories, be sure to ask for your copy of the highly informative bulletin describing FRACPAC, the industry's foremost sand control technique. Call your nearby Halliburton representative or write to:

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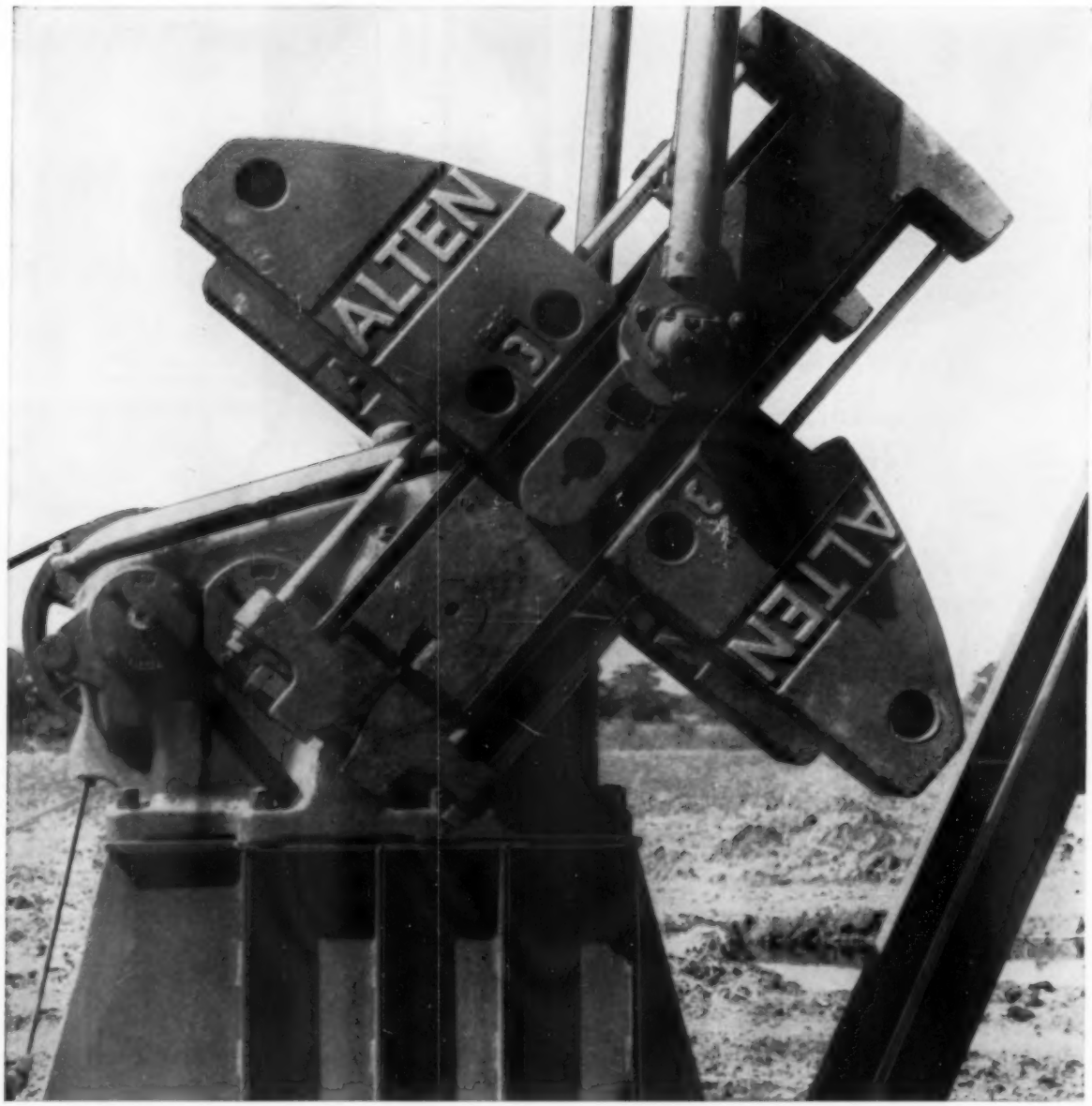
Duncan, Oklahoma

ANOTHER IMPORTANT CONTRIBUTION FROM HALLIBURTON RESEARCH



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Buchanan Directs Oil Safari

. . . in eight nations. Husky vice president says choose wildcat sites carefully to beat high exploration costs.

THE NEW PRESIDENT of the American Association of Petroleum Geologists was not exaggerating when he said he travels two-thirds of the time.

Geo. S. Buchanan is one of the most widely traveled, busiest, and best-known geologists and oil-country executives in the world.

Like the British Empire, the sun almost never sets on the leases and concessions where he has helped find oil and hopes to uncover more.

He's currently the president or an officer of seven companies. At last count these companies were busy on five continents:

. . . **Planning new wildcats** on concessions in Israel, France, Turkey, and Paraguay.

. . . **Doing preliminary geology** on other concessions in Sicily and Gautemala.

. . . **Applying for concessions** in Tunisia.

Besides this, Buchanan is playing a leading role at home, bent on finding more reserves in the Rocky Mountains, West Texas, Canada, and in the Gulf Coast area.

The Husky man . . . His company titles give a good idea of Buchanan the oil executive:

. . . **Vice president of production** for the fast-moving integrated Husky Oil Co., Cody, Wyo., where Buchanan headquarters. Husky concentrates its geological activities in the Rockies and West Texas.

. . . **Director of Canadian Husky** Oil, Ltd., an integrated Canadian firm which made five oil discoveries and five new gas discoveries in 1957.

. . . **Chairman of Rimrock Tidelands,** Inc., Shreveport, La., which has about a dozen rigs onshore and offshore in the Gulf Coast area. Husky owns 52% of this company.

. . . **President of Israel-American** Oil Corp., which is getting ready to drill a 6,000-ft. wildcat 30 miles southeast of Heletz field. Husky owns 45% of Israel-American, which holds 359,000 acres of Israeli licenses.

. . . **President of Marmara** Petroleum Corp., an Israel-American subsidiary with 450,000 acres of concessions on the European side of Turkey. The company will drill its first Turkish wildcat later this year.

. . . **President of Argus Petroleum** Corp., which has acreage in the Peten area of Gautemala. Husky owns 51% of the company.

Geo. S. Buchanan

. . . global interests keep him moving.

. . . **Vice president of Rimrock International,** Inc., newly formed subsidiary with concessions in France, Sicily and Paraguay. A 6,000-ft. test is planned 80 miles northeast of Parentis in France's Aquitanian basin.

In Paraguay, Rimrock International will drill on a 7,500,000-acre concession under an agreement made with International Products Corp. (OGJ, Feb. 3, p. 71).

Geological work is under way in Sicily, and across the Mediterranean in Africa the company has applied for Tunisian concessions.

The oil booms . . . His oil-boom background paints a picture of Buchanan, the geologist.

The year he tucked away his last degree at the University of Michigan in 1924, he started an oil-finding career that has taken him to 22 states and 10 countries.

He had experience in oil booms at Smackover (Deep) in Arkansas; Cromwell and Seminole in Oklahoma; East Texas and Conroe, Tex.; and Illinois basin.

Adams Oil & Gas Co., which he headed in 1934-39, made the first discovery at Patoka in Illinois in 1936. This was followed by the big discovery at Centralia.

Buchanan's first job was as paleontologist with Pure Oil Co. in Tulsa. Between 1925 and 1944 he was in various positions with Carter Oil Co., Tulsa Oil Co., Barnsdall, and Yegua Corp., and headquartered mostly in Tulsa and Houston.

He joined Sohio Petroleum Co. in Houston in 1944 and 4 years later was made vice president in charge of land and exploration. In 1953 he went with Husky at Cody.

The West . . . He was in home territory again, for he was born in the West (Sterling, Colo.) and reared in the Northwest (Cheny, Wash.).

He and his wife, Dorothy, have three children, all grown. Daphne, who has an M.A. degree from Columbia University, is now studying art in Florence, Italy.

Dodds, who has degrees from both Harvard and Princeton, is in Army Intelligence in Stuttgart, Germany. And George, the youngest, is studying law at the University of Michigan after winning his A.B. at Princeton.

Be more discriminate . . . Buchanan believes oil companies should be more discriminate about where they spend money and where they pinpoint costly wildcats, because "there's just not enough money to do all that should be done in exploration."

He thinks that there's still plenty of oil to be found in this country, despite the growing interest in foreign operations. But it's a matter of economics.

To beat the high-cost rap, Buchanan suggests more combines in the U. S. He points to combine successes in Venezuela and offshore operations. There's no reason, he says, why the same principle couldn't be more widespread in domestic onshore operations.

●

Albert B. Washington, plant engineer with Magnolia Petroleum Co., has been promoted to district gas engineer and transferred to Snyder, Tex., from Midland.

Harry F. Waste, former vice president and manager of engineering and management services for Canadian Bechtel, Ltd., has been elected a vice president of Bechtel Corp. Waste recently returned to Bechtel's pipeline department in San Francisco after several years in Canadian pipeline construction projects. He was project manager for Trans-Canada in 1954.

Howard S. Bunn, executive vice president and a director of Union Carbide Corp., and **Robert G. Bushnell,** vice president and director of Buckeye Pipe Line Co., have been elected directors of Buckeye.

Personals

O. C. CLIFFORD

O. C. Clifford, Jr., formerly chief geophysicist for Atlantic Refining Co., has been named to head up a new foreign exploration division now being formed by the company. He will headquarter in Dallas. **C. H. Hightower,** assistant chief geophysicist, moves up to replace Clifford. Clifford, who has been with Atlantic since 1936, is currently president of Society of Exploration Geophysicists. In Atlantic's production division, **Thomas C. Frick,** production manager at Dallas, will become manager of the South Louisiana division June 1. He succeeds **William B. Moore,** recently named manager of the domestic exploration division at Dallas. **Forrest W. Turner,** operations group manager of the Dallas-eastern region, will take over as domestic production division manager in Dallas, succeeding Frick. **A. B. Macauley,** former assistant to **L. A. Sunkel,** vice president and general manager of production, has been transferred from Dallas to Tulsa as manager of Atlantic's Oklahoma-Kansas production region. At Tulsa, Macauley will succeed **Louis F. Davis,** recently transferred to Dallas as regional division manager there.

T. C. FRICK

F. W. TURNER

Harry Horsch, formerly with Phillips Petroleum Co., has been named manager of supply and distribution for Bay Petroleum Corp. He will headquarter in Houston.

George Cree, Jr., Pampa, Tex., independent operator, has been elected new president of the Panhandle Producers and Royalty Owners Association, succeeding **John G. O'Brien** of Amarillo, Tex. Other new association officers are **J. W. Collins,** Amarillo, second vice president; **Billy B. Davis,** Pampa, first vice president; **Frank Storm, Jr.,** Amarillo, treasurer; and **F. V. Wallace,** Amarillo, secretary.

R. L. Knight, district geologist with Franco Western Oil Co., will be in charge of exploration at the company's new Farmington, N. M., district office. Knight was formerly geologist with Shell Oil Co. in Grand Junction and Durango, Colo.

A. J. Foote, chief technologist at the Montreal refinery of Shell Oil Co. of Canada, Ltd., has been appointed manager of head office manufacturing operations. He succeeds **P. Gordon,** who was recently transferred to Vancouver as assistant manager of the company's Shellburn refinery there.

F. A. Beverly has been promoted from assistant chief process engineer for Magnolia Petroleum Co. in Beaumont, Tex., to assistant supervisor of Socony Mobil Oil Co.'s manufacturing analysis and planning division. He will headquarter in the parent company's New York office.

John G. Staudt, executive vice president of Dowell Incorporated, Tulsa, has been elected president of Dowell of Canada, Ltd., new Canadian subsidiary of Dow Chemical Co. **W. R. Graves,** district manager in Canada for Dowell Incorporated, will be executive vice president and general manager of the subsidiary. **W. E. Reardon,** Dowell Incorporated vice president and director, will be vice president of the new company. Staudt and Reardon will continue to headquarter in Tulsa. Graves will maintain offices in Calgary. Formation of the subsidiary comes on the heels of a move changing Dowell Incorporated from a subsidiary to a division of Dow Chemical.

Robert S. Stewart, Huntley & Huntley, Pittsburgh, has been elected chairman of the eastern district of American Petroleum Institute's Division of Production. Vice chairmen elected at the district's spring meeting were **L. T. Evans,** East Ohio Gas Co., North Canton, Ohio; **Millard Flood,** Ohio Oil Co., Terre Haute, Ind.; **J. Robert Horner,** Delaware Gas Co., Clarksburg, W. Va.; **H. J. Magner,** Delta Drilling Co., Pittsburgh; **Wendell Moore,** Columbian Carbon Co., Charleston, W. Va.; **Quentin Wood,** Quaker State Refining Co., Bradford, Pa. Also **V. F. Sargent,** Michigan Department of Conservation, Mount Pleasant, Mich.; **H. T. Hauple,** Manufacturer's Light & Heat Co., Pittsburgh; and **Elmer Milz,** Shell Oil Co., Centralia, Ill. **Earl Linn,** Hiawatha Oil & Gas Co., Pittsburgh, has been named secretary-treasurer. **Lysle R. Kirk,** Ohio Fuel Gas Co., Columbus, is chairman of the district advisory committee.

G. H. Denison has been promoted to senior research scientist by California Research Corp.

Alexander E. Walker, chairman of the board of National Supply Co., has retired. Walker joined National Supply in 1939 and was elected president the next year. He had been chairman since 1943. Walker will continue as a consultant with National.

P. C. Spencer, chairman of the board of Sinclair Oil Corp., has been appointed treasurer of the Fifth World Petroleum Congress, Inc. He succeeds **B. B. Jennings,** who relinquished this appointment after retiring as Socony Mobil Oil Co. board chairman. Spencer also succeeded Jennings as American Petroleum Institute treasurer.

P. N. Heald has been named assistant superintendent of Shell Oil Co.'s Wood River, Ill., refinery, a new position. He has been on foreign assignment since 1951. **H. K. Sutherland,** assistant manager of Shell's head office manufacturing - technological department, has been transferred to Wood River as chief technologist there. **A. S. Lehmann** transfers from Wood River, where he has been manager of the aromatics department, to New York, where he will succeed Sutherland.

H. M. McDonald, general manager of petroleum products pipeline operations for Texas Eastern Transmission Corp. for the past 4 years, has been elected a vice president of the company. He will continue to direct operations of Texas Eastern's Little Big Inch division, which now handles all petroleum products pipelining for the firm. McDonald joined Texas Eastern in May 1947, shortly after it was formed.

R. L. Higginbottom, Madison, Kans., district superintendent for Cities Service Oil Co., has been promoted to superintendent in charge of the Oklahoma City and Seminole, Okla., production districts. **L. D. Todd, Jr.,** production foreman in the East Kansas district, will succeed Higginbottom at Madison. Cities Service has transferred **E. W. Peterman** from El Dorado, Kans., to Wichita as superintendent of the enlarged Wichita production district. He succeeds **C. D. Bradbury,** who has retired. Also, **Jim Hutchinson,** Cheney, Kans., district engineer, has been transferred to Wichita in the same capacity.

Personals

OSCAR LARSON

Oscar Larson, manager of Tidewater Oil Co.'s Avon refinery, Martinez, Calif., has been promoted to manufacturing manager of the company's western division. He succeeds **Thomas O. Edwards,** who has retired. Edwards had been manager of the division, which takes in seven states and Hawaii, since 1955. A graduate of the University of Wyoming, Larson has been with Tidewater since 1923. Tidewater also has elected **Chester A. Rude,** vice chairman of the Security-First National Bank, Los Angeles, and **Theodore Weicker, Jr.,** general partner, E. F. Hutton & Co., New York, directors of the company.

L. P. Blaser has moved up from chief engineer to general manager of manufacturing for British American Oil Co., Ltd. He will headquarter in Toronto. He succeeds **J. W. Morgan,** recently named a vice president of the company. Blaser joined British American in 1939.

Lee K. Worth, assistant to the vice president of production for Pan American Petroleum Corp. in Tulsa, has retired. Worth has been with Standard Oil Co. (Ind.) affiliates since 1921. He became assistant to Pan American's vice president of production in 1953.

Carl E. Cloud, president of Mid-South Gas Co., has been elected president of the Southern Gas Association. He succeeds **Curtis M. Smith,** vice president of Tennessee Gas Transmission Co. New SGA vice presidents are **Oliver W. Clark,** Southern Natural Gas Co., first vice president, and **James A. Wilson,** United Gas Corp., second vice president. Other officers include **Willard G. Wiegel,** Lone Star Gas Co., treasurer; **R. L. Hinch,** Nashville Gas Co., secretary; and **Frank Barragan, Jr.,** South Atlantic Gas Co., assistant secretary. **H. C. Webb,** Oklahoma Natural Gas Co., is chairman of the advisory council. **E. Clyde McGraw,** Transcontinental Gas Pipe Line Corp., is vice chairman of the council. Newly elected directors are **Joe C. Darrow,** Lone Star Gas Co.; **Halcott P. Jones,** Alabama Gas Corp.; **H. A. Eddins,** Oklahoma Natural; **G. J. Tankersley,** Western Kentucky Gas Co.; **Paul B. Payne,** Dearborn Chemical Co.; **Joe T. Innis,** Northern Natural Gas Co.; and **D. W. Weir,** Arkansas Louisiana Gas Co.

Charles M. Conner, gas engineer, has been transferred by Shell Oil Co. from Midland, Tex., to the company's Wasson gasoline plants, Denver City, Tex.

G. E. Kellis, Sinclair Refining Co., has been elected chairman of the New York section of American Society of Lubricating Engineers. **L. E. Hoyer,** American Brake Shoe Co., is vice chairman. Other officers are **J. Malych,** American Oil & Supply Co., secretary; and **C. A. Geiser,** Tidewater Oil Co., treasurer.

Eugene M. Locke, Dallas lawyer and director of Magna Oil Corp. and Dallas Tank Co., was elected president of Texas Independent Producers and Royalty Owners Association at TIPRO's annual membership meeting last week in San Antonio. **Raymond D. Reynolds,** Houston geologist and independent producer, is the new secretary.

Dr. D. D. Dunlop of Esso Research Laboratories, Baton Rouge, La., has received an award from the American Institute of Chemical Engineers for excellence in presentation of a paper at the recent national AIChE meeting in Chicago. Dunlop was co-author of the paper, "Particle Size Control in Fluid Coking," with **Dr. L. I. Griffin** and **J. F. Moser,** also of Esso Research Laboratories.

J. E. HUGHES

Jack E. Hughes has been named chief geologist for Drilling & Exploration Co., Inc., Dallas. Hughes, former chief geologist for D. D. Feldman Oil & Gas, joined Drilexco last year. **John M. Mothershead,** formerly Amarillo district geologist for Ohio Oil Co., has joined Drilexco in its new geological office at Amarillo, formed during a consolidation move in which the company closed its geological office at Abilene, Tex., and its drilling office at Midland, Tex. **Floyd A. Nunley,** drilling superintendent, has been transferred from Midland to Amarillo.

Robert E. McDonald, Salt Lake City consultant, has joined Belco Petroleum Corp. in New York as geological adviser.

I. J. Satterfield has joined the research and development division at Humble Oil & Refining Co.'s Baytown, Tex., refinery. **J. E. Spell,** formerly on military leave of absence, has rejoined the technical service division there.

DEATHS

Andrew (Andy) Morrison Rowley, 69, special oil writer for the Tulsa Tribune and Tribune oil editor for 17 years, died May 14 in a Tulsa hospital. Widely known as an oil writer, Rowley was with The Oil and Gas Journal for 14 years, 1922 to 1936, the last 2 as editor. He joined the Tribune in 1937. He presented a radio program, "Your Oil Industry," over Tulsa station KVOO for many years and at one time edited his own periodical, Oil Royalties. He was secretary-treasurer of the Association of Petroleum Writers last year. A veteran newspaperman, Rowley joined the Associated Press in Pittsburgh in 1906. His work at this time included writing oil news for a number of Pennsylvania and West Virginia papers.

Parker Haight, Houston independent operator, died May 7 in a Houston hospital after a heart attack.

P. L. Tremblay, 49, eastern division manager for Shell Oil Co. of Canada, Ltd., died April 29.

James T. Durkee, 62, comptroller, treasurer, and a director of General Petroleum Corp., died May 12 in Los Angeles after a heart attack. He had been with the company since 1919.

W. B. Hart, 67, retired superintendent of services at Atlantic Refining Co.'s Philadelphia refinery, died April 24. A graduate of the University of Pennsylvania, he joined Atlantic in 1923 as a chemist.

Harry Arthur Walker, 88, retired manager of stores in Kansas for National Supply Co., died May 8 in Tulsa.

Donald M. Clark, 37, petroleum engineer with Drilling Specialties Co. in New Orleans, died May 11 in New Orleans.

William S. Burdette, operator of his own core-analysis laboratory in Tulsa, died May 12 in a Tulsa hospital of injuries received in a fall 2 weeks ago. He was 36.

Report for 1957

British Petroleum Company

British Petroleum group sales tonnage and net income for 1957 were both at approximately the same level as in 1956 despite the fact that adverse effects of the Suez crisis had to be sustained for a longer period in 1957 than in 1956. The decline in sales in the first half of the year was offset to a large extent by an increase in the second half.

Difficult trading conditions make it more than usually hazardous to attempt at this stage to forecast results for 1958. However, BP group sales for the 12 months ended March 31, 1958 amounted to more than 57 million tons as against 53 million tons in 1957. While prices this year have been depressed by the deterioration in trading conditions, BP has in mitigation had relief from the exceptional expenses incurred last year, when it was involved in large and expensive oil purchases, in very heavy freight expenditure and in many other expenses inherent in the Suez dislocation. Thus there are factors which should bear favorably on this year's comparative results, but it is too early to say whether or not they may be outweighed by further depression in market conditions.

BP group expenditures for capital improvements in 1957 amounted to £ 100,500,000, an increase of £ 14,500,000 over the previous year. Capital expenditures are expected to again exceed the £ 100,000,000 level in 1958, necessitating the retention in the business of a substantial proportion of the earnings.

The Board of Directors have recommended a final dividend of two shillings per £ 1 ordinary stock unit free of income tax, which, together with an interim dividend of one shilling paid in October, 1957, brings total dividend payment for the year to three shillings per ordinary share, free of income tax. The annual general meeting will be held in London on May 22, 1958.

THE BRITISH PETROLEUM COMPANY

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THE BRITISH PETROLEUM COMPANY LIMITED
GROUP INCOME STATEMENT

FOR THE YEAR ENDED 31st DECEMBER

	1957	1956
Sales Proceeds	£792,992,000	£721,633,000
Deduct: Sales Taxes, Customs and Excise Duties, etc.	197,050,000	174,333,000
Net Sales	595,942,000	547,300,000
Dividends and Other Income	11,985,000	10,327,000
	607,927,000	557,627,000
Cost of Oil, Operating, Selling and Administration Expenses	434,437,000	381,480,000
Depreciation and Amounts Written off	43,463,000	37,288,000
Interest Payable	3,363,000	2,578,000
	481,263,000	421,346,000
Income Before Taxation	126,664,000	136,281,000
Taxation: United Kingdom and Overseas	71,480,000	79,631,000
	55,184,000	56,650,000
Income applicable to Minority Shareholders	550,000	456,000
Net Income for the Year	£54,634,000	£56,194,000
Attributable to:		
Consolidated Companies	52,018,000	52,718,000
Non-Consolidated Companies	2,616,000	3,476,000
	£54,634,000	£56,194,000

PRODUCTION

Crude oil production, which came again mainly from Kuwait, Iran, Iraq and Qatar, amounted in 1957 to 1,000,700 barrels daily. Due to the Suez crisis this was about 20,500 barrels per day less than in 1956 but still some 61,600 more per day than in 1955, the last normal year.

SALES

Sales of crude oil and refined products in 1957 amounted to some 1,089,000 barrels daily, approximately the same as in the previous year. Although U.K. and European sales were curtailed due to restrictions imposed owing to the Suez situation, the BP Group continued to expand its markets elsewhere. BP Canada opened its first service station early in 1957 and since then has opened various other stations.

REFINERIES

Refinery throughput from 16 refineries located in Europe, the Middle East and Australia in 1957 was 660,000 barrels daily, only 8,000 barrels per day less than in 1956. There were considerable variations in the different areas, with reductions at refineries west of Suez being offset by an almost corresponding increase at those east of Suez.

TANKERS

The Group's tanker fleet at the end of the year consisted of 157 ships totalling 2,411,000 deadweight tons. An additional 3,000,000 tons were on charter. Sixty-one new tankers totalling more than 2,300,000 tons are scheduled for delivery to the Group over the next five years. Amongst those will be twenty of 50,000 or more deadweight tons.

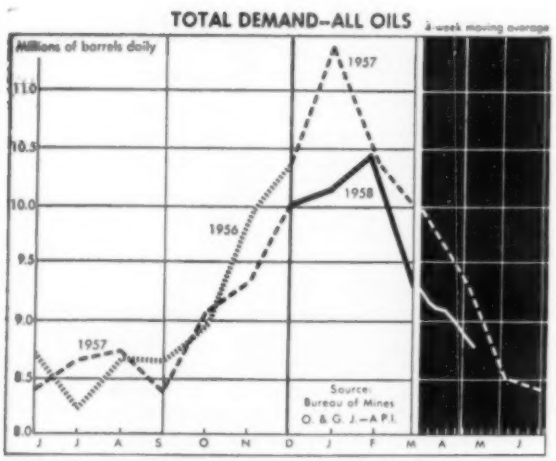
LIMITED

Copies of the Annual Report and Accounts may be obtained from the Purchasing Agent in U. S. A. for BP Trading Ltd., 610 Fifth Avenue, New York 20, N. Y.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,219,575	UP	11,700	DOWN	1,194,212
Crude stocks	276,316,000	UP	782,000	UP	13,446,000
Completions	853	UP	85	DOWN	200
Refinery runs	7,255,000	UP	177,000	DOWN	795,000
Gasoline stocks	201,235.000	DOWN	1,280,000	UP	3,833,000
Kerosine stocks	19,114,000	UP	411,000	DOWN	2,793,000
Distillate stocks	78,387,000	UP	2,121,000	DOWN	3,873,000
Residual stocks	59,120,000	UP	1,070,000	UP	20,375,000
Four-product stocks	357,856,000	UP	2,322,000	UP	17,542,000
Total imports	1,630,300	UP	126,600	UP	344,700



Residual will be the black sheep again this year

RESIDUAL FUEL has been a major factor in the disappointing demand totals so far this year. Reduced industrial activity accounts for most of the decline in consumption of heavy fuel, but some industry economists believe that residual prices have driven some industrial users to other fuels.

The supply-and-demand committee of the Independent Petroleum Association of America estimated first-quarter domestic demand for resid at 1,674,000 bbl. daily compared with 1,805,000 bbl. daily for the same period last year. This represents a drop of a little over 130,000 bbl. daily and the difference between an increase and a decrease over the first quarter last year.

Total domestic demand averaged 9,688,000 bbl. daily for the first quarter of 1957. The average this year was about 9,680,000 bbl. daily for a very small decrease. But if the 130,000-bbl.-daily loss in heavy fuel could have been saved, domestic demand would have shown a gain of about 1.2%.

Current weekly figures show that residual demand dropped still further behind in April. Total residual demand averaged a little over 1,400,000 bbl. daily for the month. Normal exports cut this total to about 1,340,000 bbl. daily for domestic demand. Revised domestic demand for April last year was 1,591,000 bbl. daily. This drop of 250,000 bbl. daily was a big factor in the poor showing for all-product demand for the month.

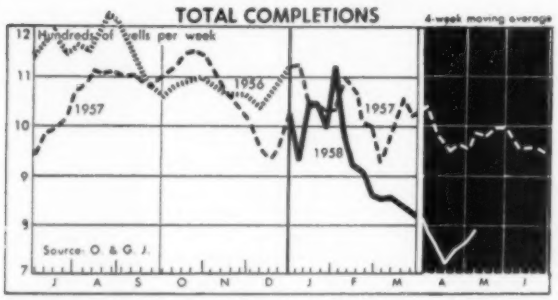
Most of the residual problem is centered on the West Coast. The decrease in demand for heavy fuel in that area has created a burdensome stock condition that can spread to other areas.

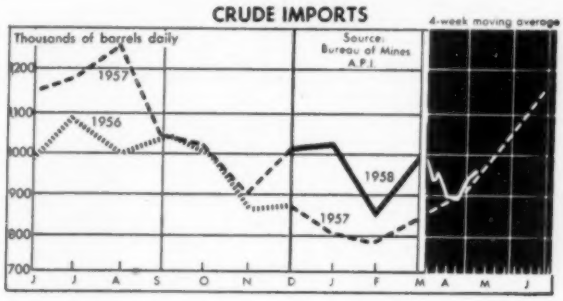
West Coast residual stocks dropped to 10,905,000 bbl. at the end of February last year. This was due to abnormal shipments during the Suez crisis, but even before movement through the canal was back to normal, California stocks started climbing. Residual inventories in the area had climbed to 26,608,000 bbl. by the end of the year and were still increasing. The total for May 5 was 31,598,000 bbl.

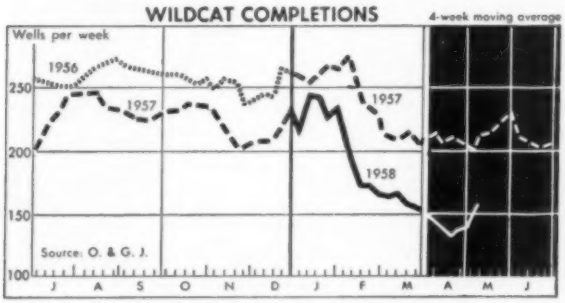
In the past, stocks that high on the West Coast created enough pressure to start shipments to the East Coast. There have been two periods of heavy shipments from West Coast to East Coast since the end of World War II.

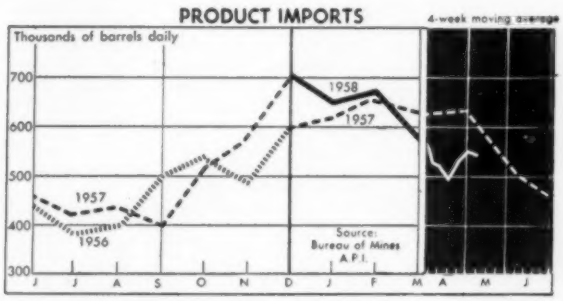
Resid stocks on the West Coast jumped to 39,900,000 bbl. in September 1949. Shipments to the East Coast started the same month and climbed to 15,400,000 bbl. for the following year. Again, pressure from stocks near the end of 1954 started shipments that totaled 11,464,000 bbl. in 1955. Resid stocks on the West Coast moved above 30,000,000 by the first of May this year, and again there is talk of a need for shipments to the East Coast.

Some marketers believe that the East Coast price will have to go lower to take enough of the industrial fuel market to make room for an additional 10,000,000 bbl. of residual fuel this fall and winter.





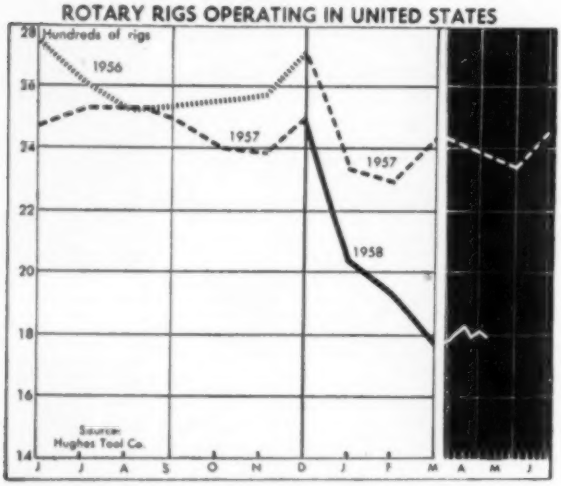




WEEKLY WELL COMPLETIONS . . . WEEK ENDED MAY 10, 1958

	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1958	1957	Total	Crude	Cond.	Gas	Dry	1958	1957
Alabama	0	0	0	0	0	0	0	24	43	0	0	0	0	0	10	17
Arkansas	13	7	0	0	6	0	34,599	229	352	3	0	0	0	3	51	55
California	35	19	0	2	14	0	128,537	671	757	11	0	0	1	10	130	188
Colorado	18	4	0	1	13	0	95,148	260	334	12	1	0	0	11	137	223
Illinois	35	12	0	1	22	0	74,331	655	833	7	0	0	0	7	140	205
Indiana	11	4	0	0	7	0	16,887	229	217	6	0	0	0	6	85	44
Kansas	78	35	0	8	32	3	282,980	1,252	1,493	13	3	0	0	10	242	276
Kentucky	21	8	0	0	13	0	31,621	318	489	5	0	0	0	5	42	103
Louisiana	51	20	8	1	22	0	403,086	1,152	1,359	7	0	1	0	6	156	242
North	22	12	0	1	9	0	76,744	394	467	2	0	0	0	2	59	50
South	26	8	6	0	12	0	290,444	602	639	5	0	1	0	4	89	159
Offshore	3	0	2	0	1	0	35,898	159	253	0	0	0	0	0	8	33
Michigan	7	4	0	0	3	0	23,534	132	142	2	0	0	0	2	43	59
Mississippi	7	3	0	0	4	0	53,212	141	131	5	1	0	0	4	72	59
Montana	3	1	0	0	2	0	16,010	131	115	1	0	0	0	1	55	41
Nebraska	8	1	0	0	7	0	44,051	222	282	3	0	0	0	3	105	155
New Mexico	24	14	0	7	3	0	112,039	681	713	4	1	0	0	3	92	104
West	13	5	0	7	1	0	50,322	321	257	1	0	0	0	1	39	41
East	11	9	0	0	2	0	61,717	360	456	3	1	0	0	2	53	63
New York	12	5	0	1	1	5	20,476	197	168	1	0	0	0	1	14	1
North Dakota	13	8	0	0	5	0	98,271	154	102	3	1	0	0	2	50	40
Ohio	19	9	0	5	3	2	48,106	346	369	0	0	0	0	0	3	3
Oklahoma	128	65	0	2	58	3	385,173	2,339	2,389	18	1	0	0	17	309	274
Pennsylvania	0	0	0	0	0	0	0	32	324	0	0	0	0	0	6	32
Texas	338	193	9	18	111	7	1,520,533	6,473	7,901	72	12	1	2	57	1,343	2,063
Dist. 1	21	6	0	3	12	0	48,102	354	448	12	1	0	1	10	132	156
Dist. 2	14	4	1	6	3	0	78,718	255	250	2	0	0	0	2	67	101
Dist. 3	22	5	1	2	14	0	172,724	449	658	9	1	0	1	7	93	220
Dist. 4	16	6	2	1	7	0	83,058	426	519	7	3	0	0	4	130	201
East	22	12	2	0	8	0	112,361	447	455	4	1	0	0	3	126	140
Dist. 7-B	49	23	0	0	25	1	135,826	841	1,066	9	1	0	0	8	240	394
West	109	84	1	0	20	4	589,762	1,934	2,245	16	2	0	0	14	272	347
Dist. 9	64	43	0	1	18	2	201,875	1,313	1,766	11	2	0	0	9	246	471
Dist. 10	21	10	2	5	4	0	98,107	454	494	2	1	1	0	0	37	33
Utah	7	5	0	0	2	0	34,015	174	66	1	0	0	0	1	31	40
West Virginia	9	1	0	6	2	0	27,814	242	219	0	0	0	0	0	9	10
Wyoming	12	6	0	2	4	0	45,506	261	294	4	0	0	1	3	80	97
Ariz., Tenn.	4	0	0	1	3	0	8,050	38	26	4	0	0	1	3	32	21
Total U. S.	**853**	424	17	55	337	20	3,503,979	16,353	19,108	**182**	20	2	5	155	3,237	4,352
Total prev. week	768	375	23	60	293	17	3,387,415	.....	.....	147	12	4	5	126	.....	.....
Cum. 1958	16,353	8,181	401	1,199	6,216	356	69,727,679	.....	.....	3,237	302	52	110	2,773	.....	.....
Western Canada	24	15	0	1	4	4	126,859	825	894	6	2	0	1	3	311	242

ROTARY RIGS OPERATING IN UNITED STATES

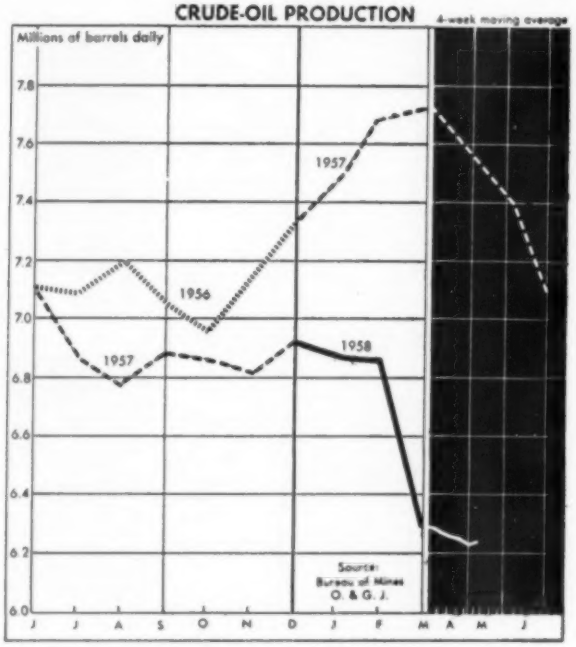


ACTIVE ROTARY RIGS*

	5-12-58	5-5-58	4-28-58	5-13-57
Alabama	5	5	5	9
Arkansas	13	13	16	21
Arizona	...	...	...	...
California	83	77	70	93
Colorado	24	29	25	43
Florida	2	1	1	1
Georgia	...	...	...	...
Idaho	...	...	...	...
Illinois	36	34	33	80
Indiana	4	11	10	6
Iowa	3	3	3	2
Kansas	129	132	120	166
Kentucky	4	5	5	10
Louisiana	272	288	306	419
North	21	27	31	54
South	213	212	219	263
Offshore	38	49	51	102
Maryland	...	...	...	...
Michigan	11	11	9	13
Missouri	...	...	...	1
Montana	22	24	21	27
Mississippi	34	28	34	31
Nebraska	30	29	20	39
Nevada	...	...	...	...
New Mexico	130	126	123	140
New York	2	...	...	1
North Dakota	36	36	32	24
Ohio	...	...	...	1
Oklahoma	196	208	192	239
Oregon	...	...	...	1
Pennsylvania	12	11	12	13
South Dakota	...	...	...	1
Texas	659	655	670	907
Gulf Coast	158	154	153	198
Offshore	1	3	2	8
West	274	271	262	374
North	195	189	215	286
East	31	38	38	41
Tennessee	...	...	...	...
Utah	34	31	34	32
Washington	1	1	1	...
West Virginia	5	5	4	1
Wyoming	50	50	45	62
Virginia	...	...	...	...
Total United States	1,797	1,813	1,791	2,383
Western Canada	108	100	78	158
Eastern Canada	2	2	1	2
Grand total	1,907	1,915	1,870	2,543

*Hughes Tools Co.

CRUDE-OIL PRODUCTION

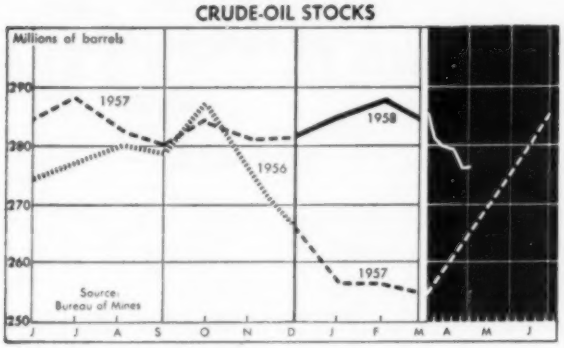


DAILY AVERAGE PRODUCTION FOR WEEK

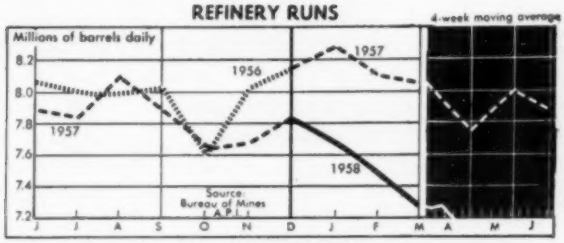
	May 10, 1958 Crude oil	Lease condensate	Total	May 3 total
Alabama	14,900	...	14,900	14,925
Arkansas	83,575	200	83,775	83,750
California	861,200	...	861,200	866,700
Colorado	138,225	...	138,225	137,975
Eastern	50,100	...	50,100	49,600
Florida	1,275	...	1,275	1,300
Illinois	216,900	...	216,900	216,000
Indiana	29,300	...	29,300	29,300
Kansas	†322,250	...	†322,250	†318,100
Kentucky	42,100	...	42,100	42,600
Louisiana	728,600	86,700	815,300	822,300
North	113,600	3,100	116,700	116,550
South	615,000	83,600	698,600	705,750
Michigan	24,500	...	24,500	24,500
Mississippi	97,450	5,000	102,450	103,100
Montana	74,150	...	74,150	71,750
Nebraska	49,800	...	49,800	50,800
Nevada	100	...	100	100
New Mexico	246,500	6,500	253,000	256,600
North Dakota	38,750	...	38,750	33,350
Oklahoma	†546,200	...	†546,200	†530,300
Texas	2,134,000	64,000	2,198,000	2,214,775
Dist. 1	45,000	400	45,400	45,400
Dist. 2	87,000	9,000	96,000	97,425
Dist. 3	315,000	32,000	347,000	347,700
Dist. 4	152,000	7,600	159,600	163,525
Dist. 5	25,000	500	25,500	26,925
Dist. 6	91,000	7,000	98,000	101,575
East Texas field	116,000	...	116,000	116,725
Dist. 7-B	122,000	100	122,100	127,100
Dist. 7-C	110,000	3,650	113,650	113,650
Dist. 8	775,000	1,600	776,600	776,600
Dist. 9	190,000	1,500	191,500	190,775
Dist. 10	106,000	650	106,650	107,375
Utah	53,200	...	53,200	39,400
Wyoming	303,950	...	303,950	300,500
Others	‡150	...	‡150	‡150
Total U. S.	6,057,175	162,400	**6,219,575**	6,207,875
Change from previous week, up			**11,700**	
Canada	†365,200	...	†365,200	†390,800
Total U. S. production—Jan. 1-May 10				849,693,075 bbl.
Same period last year (crude plus cond.)				*986,962,452 bbl.

*Includes 18,636,875 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

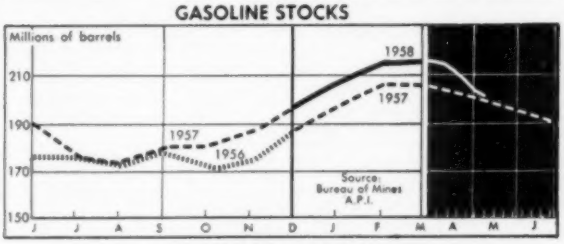
CRUDE-OIL STOCKS



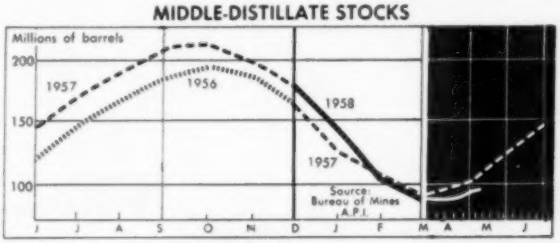
REFINERY RUNS



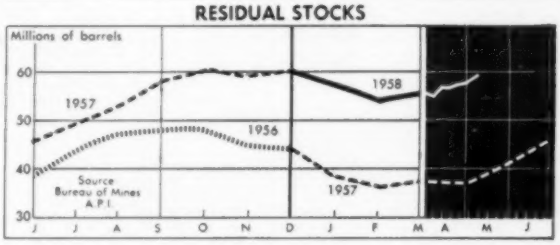
GASOLINE STOCKS



MIDDLE-DISTILLATE STOCKS



RESIDUAL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	5-3-58	4-26-58	5-4-57
Pennsylvania Grade	2,853	2,852	2,778
Other Appalachian	1,451	1,413	1,925
Illinois, Indiana, and Michigan	10,376	10,366	9,585
Nebraska and North Dakota	2,212	2,533	1,427
Kansas	10,660	10,604	10,195
Oklahoma	17,850	17,363	22,192
Arkansas	2,488	2,613	2,860
Louisiana	18,146	18,155	18,621
North	2,643	2,889	2,982
South	15,503	15,266	15,639
Mississippi, Alabama, and Florida	2,520	2,579	2,431
New Mexico	7,704	7,775	7,282
Texas	119,993	119,730	120,516
East Texas	7,304	7,409	11,116
West Texas	55,362	55,784	56,647
Texas Gulf	25,089	25,305	22,422
Other Texas	32,238	31,232	30,331
Wyoming	15,997	15,667	16,428
Other Rocky Mountain	7,458	7,568	6,077
California	38,929	38,787	26,795
Foreign	†17,679	17,529	13,758
Total	276,316	275,534	262,870

*Bureau of Mines. †Includes 4,864,000 bbl. in California.

API REFINERY REPORT, MAY 9, 1958

(Thousands of barrels)

District—	Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.	Stocks‡: Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, May 1957: Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.
East Coast	1,117	484.4	25.4	290.3	175.0	45,111	7,471	24,104	11,744	1,217	481.2	30.3	321.7	205.3
Appalachian:														
District 1	67	29.6	4.6	14.6	6.6	4,980	602	1,795	636	94	33.8	4.1	19.8	5.0
District 2	81	47.7	4.1	12.1	6.4	2,654	348	789	433	92	54.5	4.6	15.1	11.6
Ind., Ill., Ky.*	1,435	678.7	74.4	271.7	161.9	37,971	3,900	12,178	4,560	1,425	688.6	67.1	271.7	155.8
Minn., Wis., Dak.	82	37.1	7.3	20.1	13.4	5,832	633	3,651	521	102	48.4	6.7	27.2	7.5
Okla., Kans., Mo.	721	417.0	7.9	176.6	17.1	17,627	996	6,738	843	700	385.7	19.0	162.9	22.8
Inland Texas	283	199.2	9.2	46.2	19.0	7,755	363	1,478	1,998	269	198.9	7.2	51.0	20.4
Texas Gulf Coast	1,572	810.0	55.0	439.3	181.4	26,534	2,076	7,989	4,339	1,877	904.4	78.8	467.8	226.7
La. Gulf Coast	552	300.7	23.4	133.7	36.1	11,619	1,400	3,763	1,253	652	353.5	45.1	190.3	50.9
N. La. and Ark	92	26.7	5.0	21.1	6.6	5,367	788	1,745	180	83	27.6	3.6	21.9	4.7
Rocky Mountain:														
New Mexico	25	11.3	1.0	5.7	3.0	481	12	144	101	24	11.9	0.3	4.7	2.5
Other Rocky Mt.	223	100.3	1.1	51.6	31.7	7,628	176	2,506	914	253	120.8	1.5	57.1	32.1
West Coast	1,005	488.2	4.7	107.0	291.9	27,676	349	11,507	31,598	1,204	522.6	4.0	177.3	357.8
May 9, 1958	7,255	3,630.9	223.1	1,590.0	950.1	201,235	18,114	78,387	59,120	7,992	3,831.9	272.3	1,788.5	1,103.1
May 2, 1958	7,078	3,556.0	242.6	1,576.7	899.7	202,515	18,703	76,266	58,050	.....	.....	.....	.....	.....
Mayl 10, 1957	8,050	3,717.0	297.1	1,824.6	1,195.7	197,402	21,907	82,260	38,745	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipe lines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):

Regular (89 octane)	11.25-11.50
Premium (98 octane)	14.00-14.25

Gulf Coast (cargoes for coastwise or export movements):

Regular (90 octane)	9.75-10.25
Regular (92 octane)	10.00-10.50
Premium (97 octane)	11.375-11.75
Premium (98 octane)	11.875-12.50

California (rack) (Los Angeles):

Regular (88 octane)	12.0
Premium (96 octane)	14.5
Premium (98 octane)	15.0

Caribbean area (cargoes):

Regular (87 octane)	9.625
Premium (98 octane)	12.125

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:

Grade 26-70	4.5

Breckenridge:

Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):

Kerosine 42-44	9.25-9.50
Diesel oil (58 d.i. and above)	8.875-9.125
Distillate No. 1	8.875-9.125
Distillate No. 2	8.25-8.50

Gulf Coast (cargoes):

Kerosine 41-43	8.50-8.75
Distillate No. 2	8.00-8.25

New York Harbor (barges):

Kerosine 41-43	9.35
Distillate No. 2	8.85
Diesel fuel, 48-52 d.i.	9.45

Caribbean area (cargoes):

Distillate No. 2	8.125

WAX (LB.)

Oklahoma (Group 3):

132-135 A.m.p. (semi-refined) in tank cars	6.50

New York (export):

126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):

Residual fuel (max 1% S)	$1.25-1.30

Gulf Coast (cargoes):

Bunker C fuel	2.25

New York Harbor (barges):

Bunker C fuel	$2.57-2.65

Caribbean (cargoes):

Bunker C	$2.25

California (rack):

Bunker C fuel, Los Angeles	$2.45

LUBRICATING OILS

Mid-Continent (Group 3):

150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.5

Pennsylvania Grade:

145-155 vis. at 210, bright stock, 8 color, 25 p.t.	24-26
200 vis. neutral (180° at 100°), 25 p.t.	22-24

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.47	....	....	....	....
15-15.9	2.52	....	....	....	$1.81
16-16.9	2.58	....	....	....	1.86
17-17.9	2.63	....	....	....	1.91
18-18.9	2.69	....	....	....	1.96
19-19.9	2.74	....	....	....	2.01
20-20.9	2.80	$2.75	....	$2.62	2.06
21-21.9	2.85	2.77	....	2.64	2.11
22-22.9	2.91	2.79	....	2.66	2.16
23-23.9	2.96	2.81	$3.44	2.68	2.21
24-24.9	3.02	2.83	3.46	2.70	2.26
25-25.9	3.07	2.85	3.48	2.72	2.31
26-26.9	3.13	2.87	3.50	2.74	2.36
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma (sweet), part of Kansas, North Dakota, W. Texas (sweet). Some Oklahoma available for 15 cents less starting 3-17-58 and other at 10 cents less on 4-1-58. †Low cold test crude. ‡Sour.

Effective dates of broad changes: California, 4-14-58; east of California, January 3-10, 1957; Pennsylvania Grade 4-16-58.

FLAT PRICES

Louisiana:

Bienville (distillate)	$3.05
Ville Platte	3.45

Texas:

East Texas	3.25
Conroe	3.53
Van	3.08

Pennsylvania Grade:

Bradford	4.15
Middle District	3.97
Southwest Pennsylvania	3.68
West Virginia	3.50
Buckeye Grade	3.50

Illinois Basin	3.00

Canada:

Leduc-Woodbend	2.67
Redwater (Alta.)	2.56
Smiley (Sask.)	2.33
Pembina	2.52

FOREIGN

Venezuela:

Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26°-26.9°, Amuay*	2.55
Quiriquire, 16.0°-16.4°, Caripito	2.30
Lagunillas heavy, flat, Amuay or Las Piedras*	2.25
Bachaquero, flat, 15°-16°, Las Piedras*	2.08

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):

Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 35.0°-35.9°, Fao	1.98
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9°, Umm Said	2.23

Middle East, E. Mediterranean:

Arabian, 36.0°-36.9°, Sidon	2.49
Iraq, 36.0°-36.9°, Tripoli, Banias	2.49

Far East (cargoes, f.o.b. Lutong, Sarawak):

Seria Light, 37°	2.75

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(Latest reported spot fixtures)

★ Carib.-U.S.N.H., dirty (USMC—60%)	$1.08
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1500 HP—525 volts D.C.—600 R.P.M.—NEW—2-bearing continuous duty motors—manufactured by Westinghouse. In original crates. From Navy Destroyer Escort. SPECIFICATIONS: 2-bearing 1500 HP—525 volts DC—2270 amps—600 RPM—ambient temperature 40° C—class B insulation—2-bearing pedestal sleeve type—shunt wound—efficiency 94.23%. ONLY 6 AVAILABLE—BUY NOW AND SAVE. Suitable for steel mill drive—offshore oil rigs—rolling mill drive—dredge pump applications.

1200 KW GENERATORS

(2) Equal to new—manufactured by Allis-Chalmers. 1200 KW—525 volts D.C.—2290 amps—750 RPM—cooling self-ventilated—totally enclosed—separate excitation—continuous duty—class B insulation—Mfg. type M.H.C.—frog leg armature.

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3 Failing Model 1500 Drill Rigs w/25' mast, 18' kelly, 4x5 GD Pump and automatic chuck.

Mounted on Ford Marmon-Herrington Six-wheel drive tandem rear.

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WANT EQUIPMENT: Did you find the equipment you wish to purchase in this column? If not, use an "Equipment Wanted" classified advertisement to find it. It is available somewhere and Journal classified advertisements will find it. See box heading for classified rates or write The Oil Journal.

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Explosion Proof Westinghouse Type CS Frame 775S—1789 RPM—440 V.—60 Cycle, 3 phase—Style 11 N 8911 with Falk 13 F Coupling and 150 H.P.—G.E. Starting Compensator Class CR-1034-K-1.

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40,000 Ft. 10¾" O.D., .365 Wall, 40.48#

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All in approximate 40 Ft. DRL. beveled ends.

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FOR SALE: Rotary Rig Complete with National T-20 Drawworks single powered by WAK Waukesha Engine. 87' Lee C. Moore Jackknife. 7¼"x14" Oilwell Pump single powered by LeRoi L-3000 V-12 engine. 4750' of good 4½" drill pipe. 10 Drill Collars and all necessary equipment to complete rig. Call or write Travis Drillers, Inc., P. O. Box 1097, Austin, Texas. Phone GR 7-7725 or GR 8-5044.

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WANTED—

Assistant manager, drilling superintendent and petroleum engineer, all in one man, to supervise 2½ year foreign one rig drilling operation. Top salary. Bonus. Send complete resume and references. All replies held strictly confidential.

BOX K-701,
THE OIL AND GAS JOURNAL,
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For advanced studies involving thermodynamics, fluid mechanics and heat transfer in the analysis of automatic lease operation, gas processing and transmission.

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For advanced research studies leading to the development of new electronic measurement, indication and control equipment for the oil and drilling industry and related fields.

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Please send complete confidential resume to: Director, Central Research Laboratory

AMF AMERICAN Machine & Foundry Co.
P. O. Box 889—Stamford, Connecticut

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FOREIGN EMPLOYMENT. List oil companies, drilling contractors, seismograph contractors, showing where apply foreign jobs, $5.00 cash. OIML Co., Box 2603, Tulsa, Okla.

THE POSITION YOU WANT: Oil Industry companies are looking for men to fill every conceivable kind of position. If you didn't find the position in this column that you are looking for, use a "Situation Wanted" classified advertisement to state your qualifications. Some company is probably looking for your ability. See box heading for classified rates or write The Oil and Gas Journal, Tulsa, Oklahoma.

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Drilling superintendent for 2 year foreign operation. Excellent salary. Send complete resume and references. All replies held strictly confidential.

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THE OIL AND GAS JOURNAL,
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Positions involve technical service and consulting type work for petroleum refiners. Requires chemical engineers with several years experience in refinery process engineering, operations, and/or economic analysis. Positions offer a wide variety of work assignments in and expanding technical activity that works with sales, research, refinery, and company management problems. Also affords opportunity for industry-wide contacts with refining and process companies and for using initiative and individual expression to increase responsibility. Location in Detroit suburb offers ideal professional environment with a choice of city or suburban living. Send resume to:

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1600 W. 8 MILE ROAD
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ECONOMIC GEOLOGIST: Presently employed. Age 29. Six years varied experience: exploration, evaluation, interpretation and reports, plus many other mineral deposits. Seeks employment with aggressive individual or organization. Box K-691, The Oil and Gas Journal, Tulsa, Oklahoma.

COMPETENT and ambitious landman stymied in staff position. Capable of assuming District or Division responsibilities for Independent or Major; 5 years Gulf Coast, West Texas, and New Mexico experience. Box K-699, The Oil and Gas Journal, Tulsa, Oklahoma.

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SITUATION WANTED

GEOLOGIST, thoroughly familiar with Mississippi, also experienced in Louisiana and Southeastern States, desires retainer or other connection with substantial independent or company. Box K-686, The Oil and Gas Journal, Tulsa, Oklahoma.

HAVE SLIDE RULE—WILL TRAVEL. Petroleum Engineer, 41, Married. 13 years diversified experience natural gas, production, completions, workovers, and sales engineering. Box K-690, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL EXECUTIVE, young, capable; 20 years experience with large independents in all phases of oil business. Former Assistant Director API; trades, titles, land and lease; scouting and geological background; correspondence and contract expert. Vast knowledge of royalties, blocks, drilling and reserves. Accounting, taxes and public relations. Last employer sold production and quit business. Desires association with active independent. Married, no children. Will go anywhere at own expense for interview and will relocate. Best references. Salary commensurate with ability. Box K-680, The Oil and Gas Journal, Tulsa, Oklahoma.

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STAFF GEOLOGIST: 37, M.S. Geology; M.B.A. Business Management; diversified exploration and administrative experience; basin studies, planning, programming, management engineering. Require challenging position with aggressive management. Box K-693, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE HARVARD COLLEGE—Major Economics; Yale Law School, June 1957; specialist natural gas and allied problems, seeks employment in legal capacity. Author—"Pricing Standards for Producers of Natural Gas." Copy of treatise and statement of qualifications on request. Box K-697, The Oil and Gas Journal, Tulsa, Oklahoma.

HAVE SLIDE RULE—WILL TRAVEL for smaller Independents. Seismic interpretation service on hourly, daily, or per hole basis. 12 years experience. Rocky Mountain, Canada, Mid-Continent, South America, Asia. Geology degree. Box K-702, The Oil and Gas Journal, Tulsa, Oklahoma.

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JUNIOR HOUSE or Tax Counsel, 34; 5 years general practice; complete University Southern California graduate law tax courses, oil and gas, in June. Resume. Box K-684, The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, California.

SAFETY DIRECTOR ENGINEER, 13 years experience, special training in petroleum. Trucking and insurance. Ability to manage entire safety & employee training program. Will relocate. Box K-676, The Oil and Gas Journal, Tulsa, Oklahoma.

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PETROLEUM ENGINEER: 33, married, 9 years experience; water flooding, production operations, workovers, evaluations, water treatment and disposal. Desires challenging position with management potential. Box K-704, The Oil and Gas Journal, Tulsa, Oklahoma.

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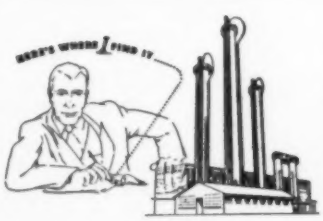

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Would like to hear from pension trust or foundation officers, who are interested in purchasing producing oil and gas minerals. Please do not answer if you are not the principal who is in position to purchase these minerals.
Box K-674, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION WANTED

WANTED: Oil properties, 100 to 5,000 barrels daily in Oklahoma and Kansas. Morris Sitrin, P. O. Box 1160, Tulsa, Okla.

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EASTERN CAPITAL seeking sizable producing oil-gas properties. Fair prices. Quick action. Box K-652, The Oil and Gas Journal, Tulsa, Oklahoma.

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Scenic ranch is "natural" for hunting & fishing lodge. Main house 4 bedrooms, 2 baths. Guest house. 60 acres fronting on river. Paved road near. $35,000, terms.
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PUERTO RICO WATER RESOURCES AUTHORITY,
P. O. Box 4267,
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FOLLOW LAKE ERIE and adjoining inland activity; Ohio, Pennsylvania, New York. On the spot weekly report, $6.00 per month, $60.00 per year. South Shore Scouting Service, Box 355, Erie, Pa.

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Sealed bids will be received until June 11, 1958, 2:00 o'clock P. M., Mountain Standard Time, and opened at that time in the Office of the Crow Indian Agency, Montana, for the leasing of 7,538.23 of tribal land located in T. 9 & 10 S., R. 38 E., T. 9 S., R. 37 E., T. 4 N., R. 33 E., and 946.65 acres of allotted lands located in T. 3 N., R. 33 E., T. 3 N., R. 34 E., Big Horn County, Montana, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of Crow Indian Agency, at Crow Agency, Montana.

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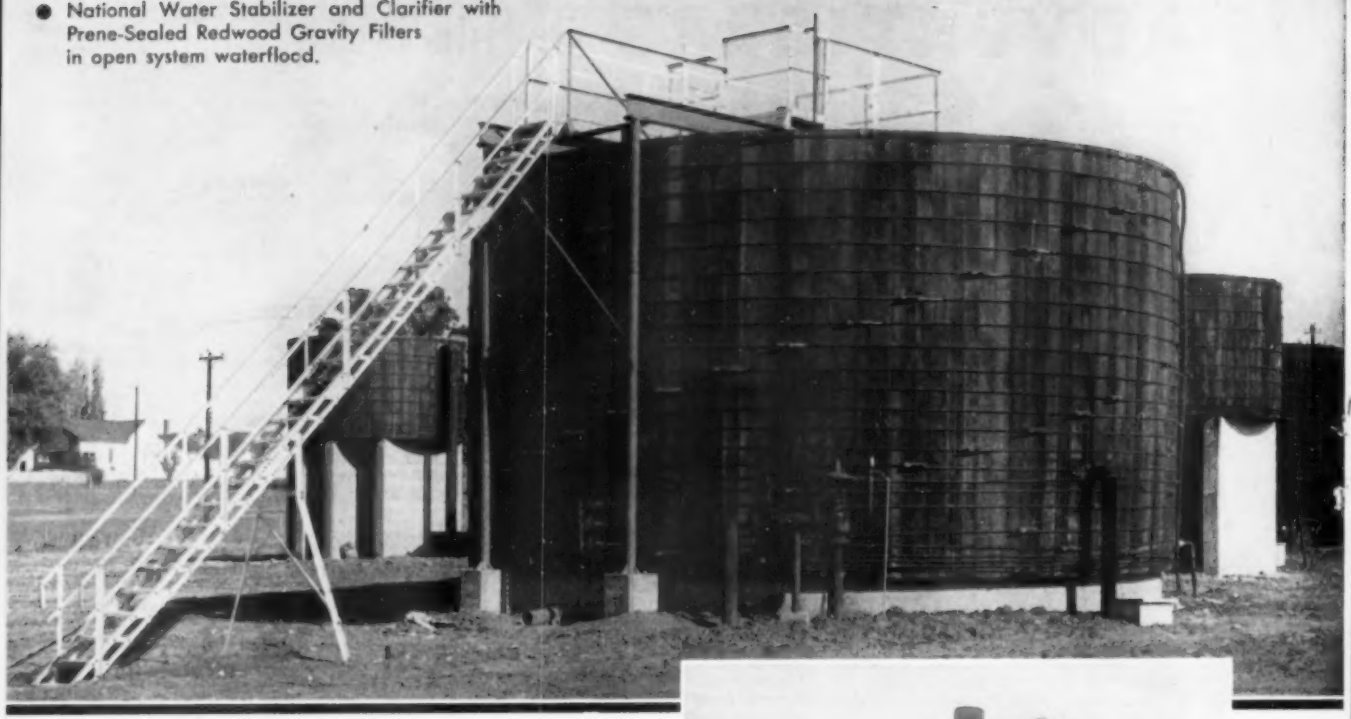

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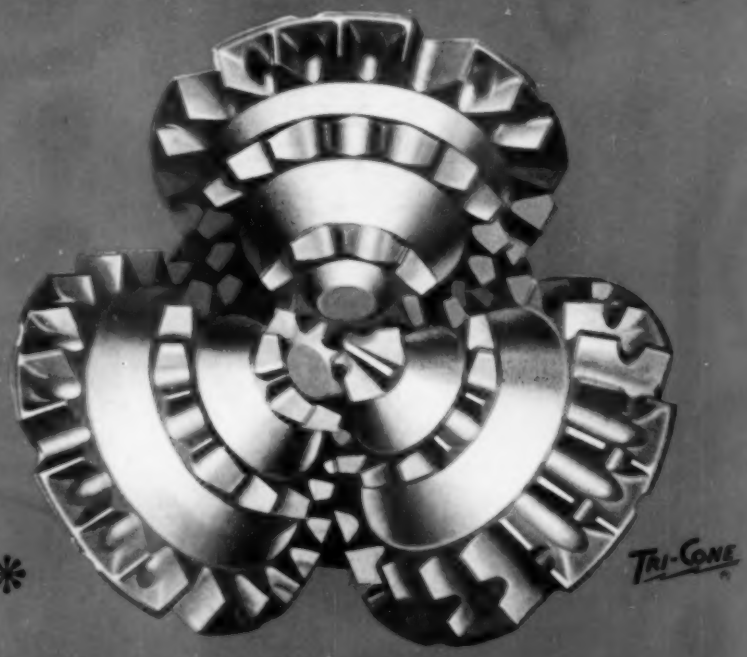

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